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**THE *KAIANUS*-GROUP OF THE GENUS *CALLIONYMUS*  
(PISCES: CALLIONYMIDAE), WITH DESCRIPTIONS  
OF SIX NEW SPECIES**

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**ABSTRACT:** The *kaianus*-group of the genus *Callionymus*, subgenus *Callionymus*, is revised. The recognized species and their ranges are: *Callionymus kaianus* Günther, 1880 (Kai Islands, eastern Indonesia); *Callionymus moretonensis* Johnson, 1971 (northern half of Australia, New Ireland, New Caledonia); *Callionymus whiteheadi* n.sp. (southwestern Indonesia); *Callionymus guentheri* n.sp. (Philippine Islands); *Callionymus formosanus* n.sp. (Formosa Strait, Taiwan); *Callionymus sokonumeri* Kamohara, 1936 (southern Japan); *Callionymus altipinnis* n.sp. (South China Sea; China coast); *Callionymus ochiaii* n.sp. (southern Japan); *Callionymus regani* Nakabo, 1979 (Saya de Malha Bank, western-central Indian Ocean); *Callionymus kotthausi* nom. nov. (for *Callionymus indicus* (Kotthaus, 1977), a secondary homonym; India); *Callionymus africanus* (Kotthaus, 1977) (east Africa); *Callionymus bentuviai* n.sp. (southern Red Sea); *Callionymus carebares* Alcock, 1890 (northern Indian Ocean).

INTRODUCTION

The dragonets of the family Callionymidae are a group of benthic marine fishes (except for two euryhaline species which enter and even live in freshwater rivers). About 130 species are known. The two largest genera, *Callionymus* and *Synchiropus*, are nearly circumtropical in warm and temperate seas, but some species also live in cold waters; e.g., *Callionymus lyra* and *C. maculatus* of the northern Atlantic follow the warm Gulf Stream to Iceland and northern Norway. Callionymids usually live on sand or mud bottoms, sometimes also on coral sand bottom in coral reefs, or among seaweed, from very shallow waters and even tide pools down to about 800 m.

*Callionymus* is the largest genus of the family, comprising about 75 species. Fricke (1980) distinguished three subgenera (*Callionymus*, *Cal-*

*liurichthys*, and *Spinicapitichthys*) which differ principally in the shape of the preopercular spine. The subgenus *Callionymus* is the largest, comprising about 55 species which can be arranged into various species groups. The *kaianus*-group is one of the larger species groups and contains deepwater mud-bottom species of the Indian and western Pacific oceans.

Seven of the species included in the *kaianus*-group have been described. *Callionymus kaianus* Günther, 1880, was originally described from Kai Islands, west of New Guinea, and later recorded from India, Indonesia, Saya de Malha Bank (western-central Indian Ocean), Zanzibar, Arabian Sea, Japan, Pescadore Islands (near Taiwan), Gulf of Tonkin, and the coast of China. Johnson (1971) described a new subspecies, *Callionymus kaianus moretonensis*, from north-eastern Australia. *Callionymus carebares* Al-

cock, 1890, was described from the Bay of Bengal; *C. sokonumeri* Kamohara, 1936, from Japan; and *C. regani* Nakabo, 1979, from the Saya de Malha Bank. Under the generic name *Diplogrammus*, Kotthaus (1977) described two further species, *D. africanus* and *D. indicus*.

I found several closely allied new species, which are described and compared in the present paper, from examination of specimens (most previously identified as *Callionymus kaianus*) in the Australian Museum, Sydney (AMS); British Museum (Natural History), London (BMNH); California Academy of Sciences, San Francisco (CAS); Faculty of Agriculture of Kyoto University, Kyoto (FAKU); Fish Collection, Hebrew University of Jerusalem (HUJF); Institut Royal des Sciences Naturelles, Brussels (IRSN); Marine Science Laboratory, Chinese University of Hong Kong (MSL); Staatliches Naturhistorisches Museum, Braunschweig (NMB); Zoologisches Institut und Zoologisches Museum der Universität Hamburg (ZIM); and Museum für Naturkunde, Zoologisches Museum, East Berlin (ZMB).

METHODS

Methods used are the same as those in my previous papers (especially Fricke 1980; Fricke 1981a).

The preopercular spine formula, explained by Fricke (1981a), is calculated by the following formula:

$$a \frac{b}{c} d,$$

where *a* is the number of antrorse spines at the base, *b* is the number of points or serrae at the dorsal edge, *c* is the number of points or serrae at the ventral edge, and *d* is 1 and reflects the main tip of the spine. The formula treats simplified left spines. Right spines have to be treated as left (e.g., the number of antrorse spines at the base, *a*, is always on the left side of the formula).

The pectoral fin base is divided in two by a membrane connecting it with the fifth pelvic fin ray. The formula *a/b* is used where *a* is the pectoral fin base length above the connecting membrane, *b* is the corresponding length below.

THE *CALLIONYMUS KAIANUS*-GROUP

The *Callionymus kaianus*-group, including the new species described in this paper, com-

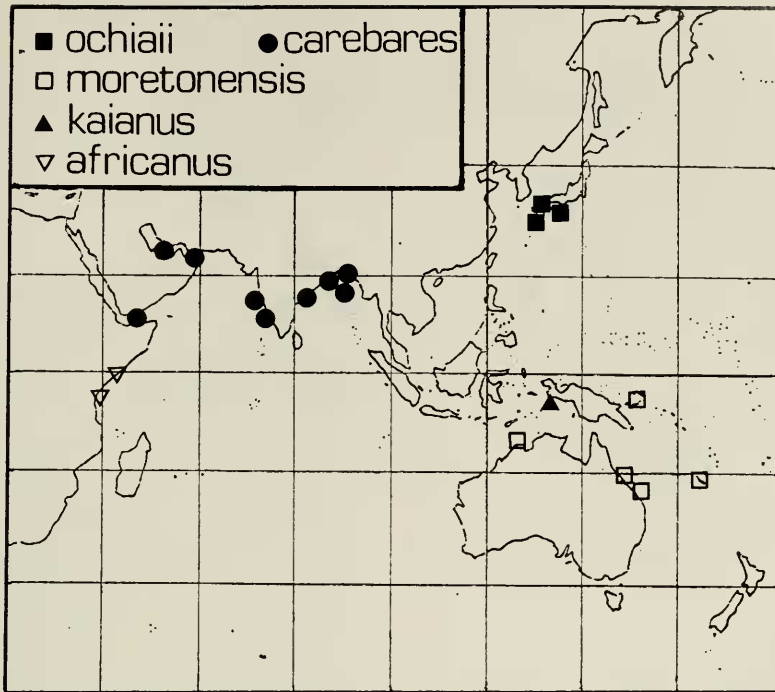
prises thirteen deepwater mud-bottom species in the subgenus *Callionymus* (see Fricke 1980:59) distributed in the Indian and west Pacific oceans (Figs. 1 & 2): *Callionymus kaianus*, *C. moretonensis*, *C. whiteheadi*, *C. guentheri*, *C. sokonumeri*, *C. formosanus*, *C. altipinnis*, *C. ochiaii*, *C. regani*, *C. kotthausi*, *C. africanus*, *C. bentuviai*, and *C. carebares*. The group is characterized by the presence in its members of large eyes; dorsal and anal fin formulae D IV + viii,1, A (vii,1-)viii,1; one or two unbranched median caudal fin rays which are often filamentous; a characteristic shape of the preopercular spine (see Fig. 3); and (usually) a characteristic black blotch on the third membrane of the first dorsal fin.

Species of the *kaianus*-group are similar to the deepwater mud-bottom species groups of the genus *Synchiropus* (e.g., *phaeton*-group, *altivelis*-group), agreeing with them in some aspects of body shape and even color markings (black spot on third membrane of first dorsal fin, etc.). The *Synchiropus* species groups are easily distinguished from the *kaianus*-group by the shape of the preopercular spine and by generic differences between *Callionymus* and *Synchiropus* discussed in detail in my revision of the genus *Synchiropus* (Fricke 1981b).

Characters and distribution of the species of the *kaianus*-group are compared in Tables 1-2. Further distinguishing features (not compared in the tables) include other proportions, the preopercular spine shape, and body color pattern.

Key to the Species of the *Callionymus kaianus*-Group

- 1a. Head in SL 2.7-3.1; branchial opening very broad, same size as or larger than pupil; upper edge of preopercular spine with 2 large curved points, but without a small antrorse point ..... *C. carebares*
- 1b. Head in SL 3.4-4.6; branchial opening small, about 1/3-1/2 of pupil; upper edge of preopercular spine with 1 small antrorse and 1 or 2 large curved points ... 2
- 2a. D<sub>2</sub> and anal fins very high, males with convex distal margins ..... 3
- 2b. D<sub>2</sub> and anal fins relatively low, with straight distal margins ..... 6
- 3a. First spine of D<sub>1</sub> filamentous ..... 4
- 3b. First spine of D<sub>1</sub> not filamentous ..... 5

FIGURE 1. Geographical distribution of species of the *kaianus*-group of the genus *Callionymus*.

- 4a.  $D_2$  relatively low, 1st ray about 1.0, 5th ray about 0.9 in head length; preopercular spine with 2 curved points (and 1 small antrorse point) at its upper side; black blotch on 3rd membrane of  $D_1$  large, nearly covering entire membrane; anal fin with a distal black streak on each membrane; distal  $\frac{2}{3}$  of anal fin dark brown, tips of rays white ..... *C. formosanus*
- 4b.  $D_2$  high, 1st ray about 1.1, 5th ray about 0.8 in head; preopercular spine with 1 large curved point (and 1 small antrorse point) at its upper side; black blotch on 3rd membrane of  $D_1$  small, distal in position; anal fin without a distal black streak on each membrane; distal margin of anal fin black, tips of fin rays also black ..... *C. altipinnis*
- 5a. Main tip of preopercular spine long and slender; distal half of anal fin black, tips of rays white; distal margin of caudal fin regular; black blotch on 3rd membrane of  $D_1$  relatively large, central in position (not reaching distal margin) ..... *C. guentheri*
- 5b. Main tip of preopercular spine short; anal fin with a distal black streak on each membrane, distal  $\frac{2}{3}$  of membranes and tips of fin rays brown; distal margin of caudal fin irregular; black blotch on 3rd membrane of  $D_1$  very small, extremely distal in position ..... *C. sokonumeri*
- 6a. Caudal fin convex, without filaments .. 7
- 6b. Caudal fin convex or slightly pointed, with 1 or 2 filaments ..... 10
- 7a. Anal fin with a small distal yellow margin or colorless; sides of body with a row of large indistinct brownish blotches ..... *C. regani*
- 7b. Anal fin with a broad dark brown or black margin; sides of body with a row of small distinct black blotches ..... 8
- 8a. Main tip of preopercular spine long and slender; lower part of caudal fin colorless ..... *C. kotthausi*
- 8b. Main tip of preopercular spine short; lower part of caudal fin with a broad black streak ..... 9
- 9a. Pectoral fin base with a large dark brown

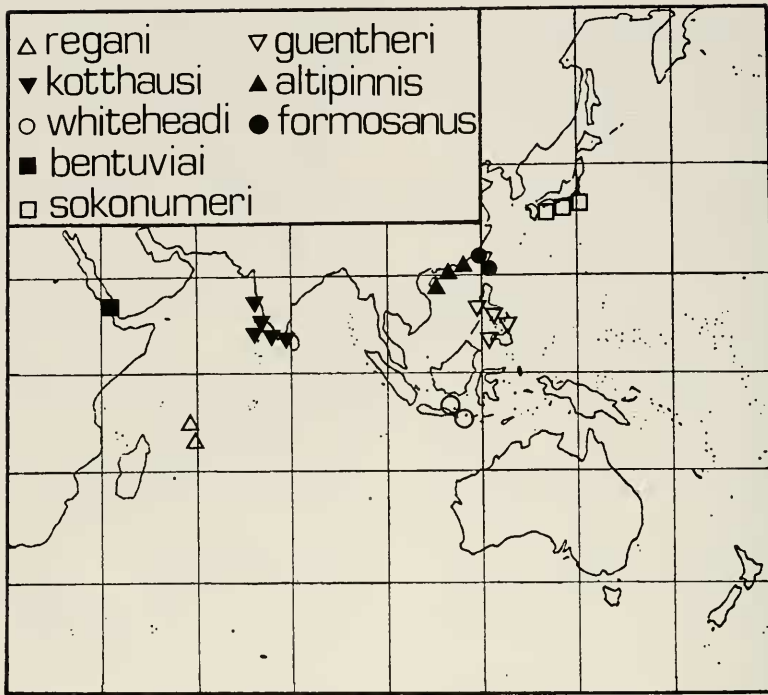


FIGURE 2. Geographical distribution of species of the *kaianus*-group of the genus *Callionymus*.

- area; back marbled with olive-green; operculum with large white spots; lower part of caudal fin black distally; D<sub>2</sub> with a basal row of dark blotches ..... *C. whiteheadi*
- 9b. Pectoral fin base with 2 black streaks; back yellowish brown, with white blotches surrounded by semicircular dark brown bands; operculum with small black spots; lower part of caudal fin with a broad, curved black band, but colorless distally; D<sub>2</sub> without a basal row of black spots ..... *C. africanus* (female)
- 10a. First spine of D<sub>1</sub> with a long filament ..... 11
- 10b. First spine of D<sub>1</sub> without a filament ..... 13
- 11a. Main tip of preopercular spine short, largest point on its dorsal side with a basal hook; D<sub>2</sub> colorless, with transverse white lines; sides of body with a row of distinct black blotches ..... *C. kaianus*
- 11b. Main tip of preopercular spine long and slender, largest point on its dorsal side without a basal hook; D<sub>2</sub> with rows of blotches; sides of body with a row of indistinct brownish blotches ..... 12
- 12a. Anal fin with a dark margin; D<sub>2</sub> with 2 rows of white blotches and a darkish distal margin; main tip of preopercular spine about 2.5–3.0 times as long as largest point at its dorsal side; body with light blotches edged with semicircular dark lines ..... *C. moretonensis*
- 12b. Anal fin pale, without a dark margin; D<sub>2</sub> with a basal and 2–3 more distal rows of dark spots; main tip of preopercular spine about 1.0–1.5 times as long as largest point at its dorsal side; body with minute blackish spots forming rings and blotches ..... *C. ochiaii*
- 13a. Second membrane of D<sub>1</sub> deeply incised; caudal fin with 2 long filaments which are nearly twice as long as rest of fin; D<sub>1</sub> with 2 or more black blotches, largest reaching from 1st to 4th spine; D<sub>2</sub> with vertical dark streaks ..... *C. bentuviai*
- 13b. Second membrane of D<sub>1</sub> not incised; caudal fin with 1 or 2 relatively short fil-



aments which are not longer than rest of fin;  $D_1$  with a black blotch on 3rd membrane (rarely also with an additional black blotch distally on the same membrane), occasionally reaching to 2nd spine;  $D_2$  with rows of dark and/or light blotches (but without vertical dark streaks) ..... 14

- 14a. Lateral line in area behind eye with a long branch running downwards;  $D_1$  with a large black blotch basally on 3rd membrane, 1 or 2 branches of which reach 2nd membrane; pectoral fin base with 2 dark streaks; anal fin with a distal black margin (usually including tips of fin rays); caudal fin without 2 median transverse black lines;  $D_2$  with 1 basal, 1 median, and 1 distal row of light spots and 2 median rows of black spots .....  
 ..... *C. africanus* (male)
- 14b. Lateral line without a branch in the post-orbital area;  $D_1$  with a relatively small distal black blotch on 3rd membrane; pectoral fin base with a dark area; distal half of anal fin black, tips of fin rays white; caudal fin with 2 median transverse black lines;  $D_2$  with a basal and a median row of black blotches .....  
 ..... *C. guentheri* (female)

### *Callionymus carebares* Alcock, 1890

(Figures 4–5)

*Callionymus carebares* ALCOCK, 1890:209 ("off Madras coast, 98–102 fms"); 1898:73; 1899:pl. 20, fig. 4; REGAN 1906:329 (Sea of Oman, 98–180 fms [179–329 m]); SMITH 1963:555, pl. 84K (after Alcock).

MATERIAL EXAMINED.—**Syntypes:** BMNH 1890.11.28.18–24, 2 ♂, 5 ♀, "Investigator," off Ganjam Coast, India.

Other specimens: BMNH 1903.5.14.34, 1 spec., 39.0 mm SL, J. W. Townsend, Karachi. BMNH 1903.9.24.2–4, 3 spec., J. W. Townsend, Iranian Mekran coast, Gulf of Oman (25°19'N, 58°21'E), 98 fms (179 m). BMNH 1904.5.25.218–220, 3 spec., J. W. Townsend, Sea of Oman, 180 fms (329 m). BMNH 1939.5.24.1384, 1 spec., John Murray Exped., 23 Nov. 1933, Gulf of Oman, 193 m. BMNH 1939.5.24.1385–1409, 24 spec., John Murray Exped., Arabian Sea, 135–183 m. BMNH 1939.5.24.1410–1421, 15 spec., John Murray Exped., Gulf of Aden, 220 m. IRSN 1797, 2 ♀, M. Frank, 4 Apr. 1894, Gulf of Bengal. FMNH 5740, 1 ♀, J. W. Townsend, 1906, Sea of Oman (Dr. D. J. Stewart, FMNH, kindly examined the specimen).

DIAGNOSIS.—A *Callionymus* of the *kaianus*-group with a very large branchial opening (same size as, or larger than, pupil), an unusually large

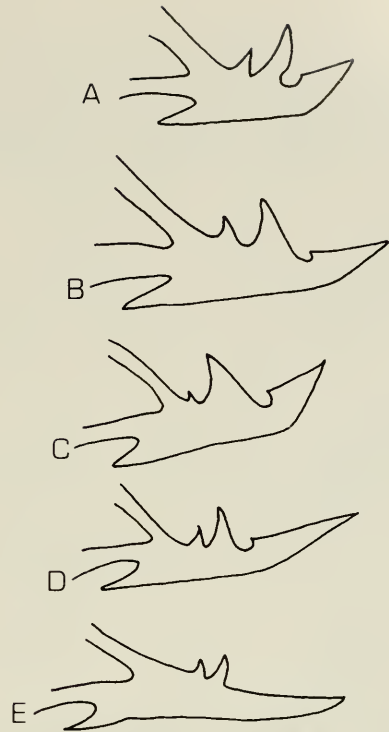


FIGURE 3. Preopercular spines of species of the *kaianus*-group. The main characteristics are the straight ventral side of the spine, the strong straight antrorse point, the upcurved main tip, and the antrorse spine in combination with two (rarely one) large curved points on the dorsal side. (A) Left preopercular spine of *Callionymus kaianus*. (B) Left preopercular spine of *C. guentheri*. (C) Left preopercular spine of *C. africanus*. (D) Left preopercular spine of *C. moretonensis*. (E) Left preopercular spine of the most primitive species of the *kaianus*-group, *C. carebares* (without an antrorse point on the dorsal side).

head (head length in SL 2.7–3.1), and two large curved points, but without a small antrorse spine at dorsal edge of preopercular spine.

DESCRIPTION.—Counts and measurements (see also Table 1):  $D_1$  IV;  $D_2$  viii,1; A viii,1;  $P_1$  ii–iii,14–16.iii;  $P_2$  1.5; C ii,2–3,0–ii,2–4.iii.

Body elongate and depressed. Head very large, depressed, 2.7–3.1 in SL. Eye large, 2.7–3.5 in head. Pupil large, about 2.5 in eye. Branchial opening very large, same size as pupil or larger. Occipital region with a bony plate and two low bony protuberances. Preopercular spine nearly as long as eye diameter, with a long, slightly upcurved main tip, two curved points at its dorsal side and a large antrorse spine at its

TABLE 1. CHARACTER AND DISTRIBUTIONAL COMPARISONS OF SPECIES OF THE *Callionymus kaitiatus*-GROUP (see also Table 2). SL = standard length; HL = head length.

	<i>C. regani</i>	<i>C. kothaasi</i>	<i>C. bentivivai</i>	<i>C. africanus</i>	<i>C. whiteheadi</i>	<i>C. carebares</i>
Distribution area	Saya de Malha Bank	s India	s Red Sea	E African coast	W Indonesia	N Indian Ocean
Fin rays: D	IV + viii, 1	IV + viii, 1	IV + viii, 1	IV + viii, 1	IV + viii, 1	IV + viii, 1
A	viii, 1	viii, 1	viii, 1	viii, 1	viii, 1	viii, 1
P	19-21	19-21	18-20	19-22	19-20	21
Preopercular spine formula	$\frac{3}{-} \frac{1}{-} \frac{1}{-}$	$\frac{2-3}{-} \frac{1}{-} \frac{1}{-}$	$\frac{3}{-} \frac{1}{-} \frac{1}{-}$	$\frac{3}{-} \frac{1}{-} \frac{1}{-}$	$\frac{2-3}{-} \frac{1}{-} \frac{1}{-}$	$\frac{2}{-} \frac{1}{-} \frac{1}{-}$
Head length in SL	ca. 4.1	3.8-3.9	3.6-4.1	3.9-4.1	3.9-4.2	2.7-3.1
Predorsal (1) length in SL	ca. 3.7	3.3-3.4	3.4-3.7	3.5-3.6	3.5-3.6	2.2-2.6
Predorsal (2) length in SL	ca. 2.3	2.2-2.3	2.1-2.3	2.1-2.3	2.2-2.3	1.8-1.9
Preadanal length in SL	ca. 2.1	2.0-2.1	1.8-2.1	1.9-2.1	1.9-2.0	1.6-1.8
Eye diameter in HL	ca. 2.7	2.3-2.5	2.1-2.9	2.0-2.2	2.2-2.3	2.7-3.5
Pelvic fin length in HL	ca. 1.0	1.1-1.2	0.8-0.9	1.0-1.1	1.1-1.2	1.3-1.5
First D <sub>1</sub> spine in HL	ca. 1.15	1.3-1.4	0.9-1.1	1.3-1.5	1.2-1.3	1.7-1.8
Longest C ray in SL	ca. 3.0 (♂♂ and ♀♀)	2.0 (♂♂)-3.3 (♀♀)	1.2-1.7	2.4-3.3	3.4-3.7	2.5-3.4
First D <sub>1</sub> spine filament	lacking	lacking or very short	lacking	lacking	lacking	very short, only in ♀♀
Caudal fin filaments	lacking	lacking or (rarely in ♂♂) 2 (very short)	2 (very long)	2 (short)	lacking	2 (very short)
Second D <sub>1</sub> membrane	present as usual	present as usual	deeply inverted	present as usual	present as usual	present as usual
Distal dark streak on A	absent	present	present (very broad)	present (narrow)	present	present
Dark blotch on D <sub>1</sub>	only on 3rd membrane	♂: 2 blotches on 2nd & 3rd membranes; ♀: 1 blotch from 1st to 3rd membrane	2 dark blotches on 3rd membrane; lower one reaching to 1st spine	1 dark blotch on 3rd membrane; occasionally reaching to 2nd spine	on 3rd membrane, basal in position, w/basal branch to 2nd membrane	♀♀: on 2nd & 3rd membrane; ♂♂: black spot lacking
Head color pattern	cheeks dark brn. w/ light spots	brn. w/some irregular darkish spots	brn. w/black spots on operculum	w/few irregular darkish spots	many dark spots on cheeks	monochromatic gray
Caudal fin color pattern	nearly colorless	w/3-4 vertical rows of lt. brownish spots	upper part w/small, lower part w/broad dark curved line	upper part w/small dark spots, lower part w/broad dark band	upper part w/large dark blotches; lower part distally dark	distal margin dark
Fifth ray D <sub>2</sub> in HL	ca. 1.35	ca. 1.65	ca. 1.2	ca. 1.5	1.5-1.7	1.8-2.0
Fifth ray A in HL	ca. 2.05	ca. 2.25	ca. 1.9	ca. 2.3	2.5-2.6	2.2-2.3
D <sub>2</sub> color pattern	w/white spots & lines	w/3 rows dark blotches	w/9 vertical dark streaks	w/rows of dark & white spots	basal row of dark spots	distal margin darkish

TABLE 2. CHARACTER AND DISTRIBUTIONAL COMPARISONS OF SPECIES OF THE *Callionymus kaitanus*-GROUP (see also Table 1). SL = standard length; HL = head length.

	<i>C. kaitanus</i>	<i>C. moretonensis</i>	<i>C. guentheri</i>	<i>C. altipinnis</i>	<i>C. sokonumeri</i>	<i>C. ochiati</i>	<i>C. formosanus</i>
Distribution area	Kal Is.	N Austr., sw Pac.	Philippines	S. China Sea	s Japan	s Japan	Taiwan
Fin rays: D	IV + viii, 1	IV + viii, 1	IV + viii, 1	IV + viii, 1	IV + viii, 1	IV + viii, 1	IV + viii, 1
A	viii, 1	viii, 1	viii, 1	viii, 1	viii, 1	viii, 1	viii, 1
P	21-22	19-21	21	17-18	18-20	18-21	20-21
Preopercular spine formula	$\frac{3}{-}1$	$\frac{3}{-}1$	$\frac{3}{-}1$	$\frac{2}{-}1$	$\frac{3}{-}1$	$\frac{3}{-}1$	$\frac{3}{-}1$
Head length in SL	ca. 4.6	3.4-4.7	ca. 4.0	ca. 4.2	3.6-4.4	ca. 4.5	ca. 4.5
Predorsal (1) length in SL	ca. 3.8	3.0-3.8	ca. 3.45	ca. 3.6	ca. 3.9	ca. 3.7	ca. 3.75
Predorsal (2) length in SL	ca. 2.4	2.1-2.4	ca. 2.2	ca. 2.25	ca. 2.3	ca. 2.25	ca. 2.4
Prenasal length in SL	ca. 2.2	1.8-2.2	ca. 2.0	ca. 2.0	ca. 2.15	ca. 2.05	ca. 2.25
Eye diameter in HL	ca. 2.35	2.0-2.4	ca. 2.3	ca. 2.55	2.1-2.9	ca. 2.3	ca. 2.3
Pelvic fin length in HL	ca. 1.0	ca. 0.95	ca. 1.0	ca. 0.95	0.9-1.1	ca. 1.0	ca. 0.9
First D <sub>1</sub> spine in HL	ca. 0.85	0.8-1.5	ca. 1.2	ca. 0.65	ca. 1.0	ca. 1.4	ca. 0.7
Longest C ray in SL	ca. 2.4	2.5-3.7	ca. 2.0	ca. 2.6	ca. 2.45	ca. 3.0	ca. 2.15
First D <sub>1</sub> spine filament	present	present (short)	lacking	present	lacking	present (very short)	present
Caudal fin filaments	2	2 (short)	1-2 in ♂♂	1(-2)	2 (long)	2 (short)	1(-2)
Second D <sub>1</sub> membrane	present as usual	present as usual	present as usual	present as usual	present as usual	present as usual	present as usual
Distal dark streak on A	absent	present	present	present	present	absent	present
Dark blotch on D <sub>1</sub>	on 3rd membrane, basally reaching to 2nd membrane	on 3rd membrane, a basal branch reaching to 2nd spine	distally on 3rd membrane	distally on 3rd membrane	distally on 3rd membrane	on 3rd membrane; occasionally w/ a branch to 2nd membrane	only on 3rd membrane
Head color pattern	lt. brn. w/irregular dark blotches & spots	monochromatic brn.	w/few dark spots	monochromatic	w/few dark blotches	like body pattern	brn. w/few light spots
Caudal fin color pattern	upper part w/irregular dark spots, lower part w/a dark band	upper & lower parts w/dark streaks	upper part w/few small dark spots, lower part w/a dark band	dusky	w/irregular whitish spots	upper part: w/irregular dark spots; lower part w/a dark band	upper part w/few dark spots; lower part w/a dark lower & distal area
Fifth ray D <sub>2</sub> in HL	ca. 1.2	1.2-1.7	ca. 1.4	ca. 0.8	0.7-1.3	1.2-2.2	ca. 0.9
Fifth ray A in HL	ca. 1.75	1.4-2.4	ca. 1.85	ca. 1.2	ca. 1.2	ca. 2.0	ca. 1.3
D <sub>2</sub> color pattern	white streaks	2 rows white spots	dark spots or vertical dark streaks	colorless	gray, w/vertical dark streaks	w/irregular dark markings	w/vertical light streaks; anterior distal part black

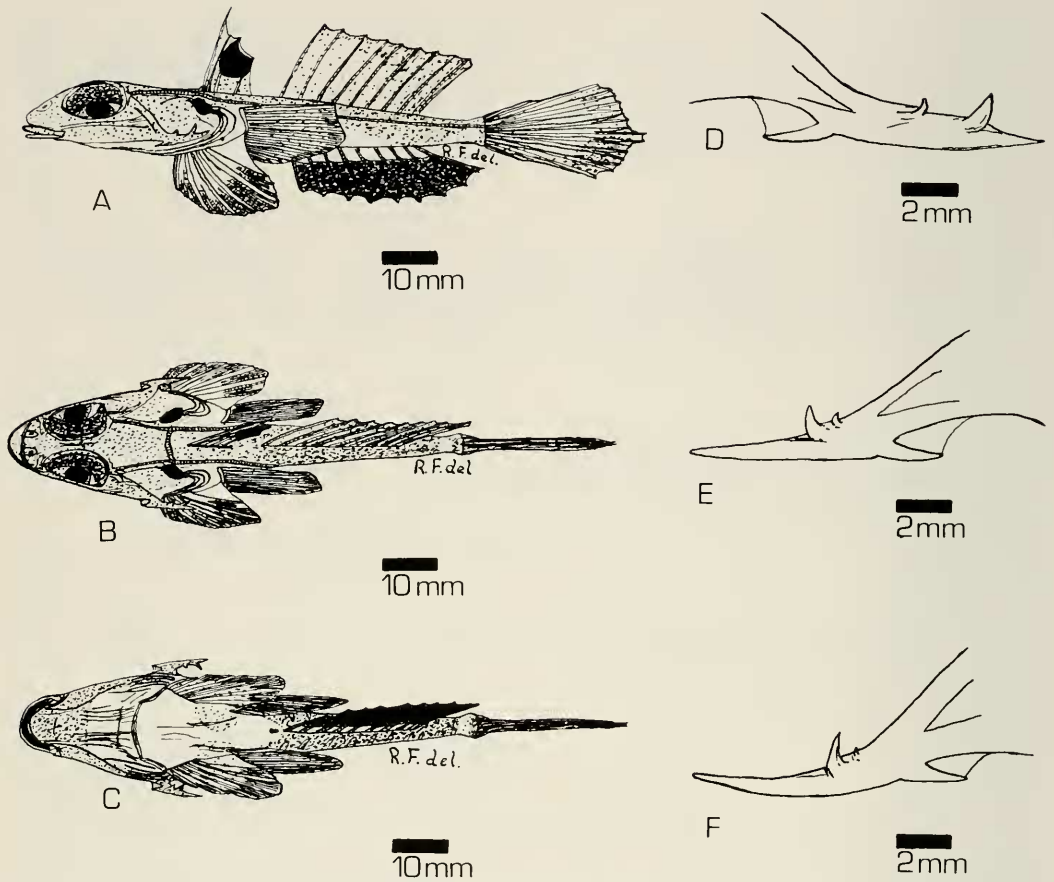


FIGURE 4. *Callionymus carebares*, IRSN 1797, Gulf of Bengal. Specimen 1, female, 85.8 mm SL: (A) lateral view; (B) dorsal view; (C) ventral view; (D) left preopercular spine; (E) right preopercular spine. Specimen 2, female, 86.2 mm SL: (F) right preopercular spine.

base (formula:  $1-\frac{2}{-}1$ ; see Fig. 4D-F). Lateral line reaching from hind margin of eye to base of caudal fin; the line of the opposite side is interconnected by a transverse branch across the occipital region. Caudal peduncle length 5.8-6.6 in SL, minimal caudal peduncle depth 21.0-22.6 in SL.

First spine of first dorsal fin nearly as long as first ray of second dorsal fin, filamentous only in females. Distal margin of second dorsal fin straight. Anal fin beginning on vertical through second ray of second dorsal fin. Distal margin of caudal fin slightly convex, the two median rays elongate but usually not filamentous. Outer edge of pelvic fin convex; longest pelvic fin ray reaching to base of first anal fin ray. Pectoral fin reaching nearly to fifth ray of second dorsal fin when laid back.

Color in alcohol. Head and body dark gray, belly white. Eye darkish. First dorsal fin in male monochromatic dark, in female nearly colorless, with a large distal dark blotch reaching from second to fourth spine. Second dorsal fin colorless, distal margin darkish. Distal one-third of caudal fin dark. Distal two-thirds of anal fin black, anal fin base colorless. Pelvic fin colorless, pectoral fin with few dark spots.

DISTRIBUTION.—Northern parts of Indian Ocean: Gulf of Aden, Gulf of Oman, coast of India, Arabian Sea (see Fig. 1); 135-330 m on muddy bottoms.

DISCUSSION.—*Callionymus carebares* seems to be the most primitive member of the *kaianus*-group based on the shapes of its preopercular spine (no antrorse spine at its dorsal side) and caudal fin (often no median unbranched ray



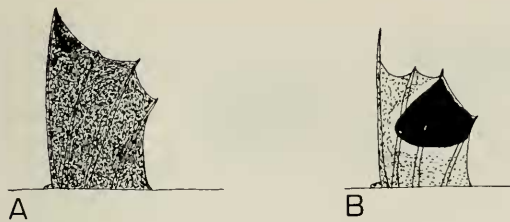


FIGURE 5. First dorsal fin in *Callionymus carebares*. (A) BMNH 1890.11.28.18, male, 95.0 mm SL, syntype, Ganjam coast, India. (B) BMNH 1890.11.28.19, female, 86.2 mm SL, syntype, Ganjam coast, India.

present). It is also unique, however, in its very large head and its extremely large branchial opening (which is porelike and very small in other callionymid fishes). Therefore, it seems to belong to another evolutionary branch in the *kaianus*-group, and I assign it to a subgroup of its own. Juvenile specimens, which have a smaller head and a smaller branchial opening, are more similar to the other species of the *kaianus*-group.

### *Callionymus kaianus* Günther, 1880

(Figure 6)

*Callionymus kaianus* GÜNTHER, 1880:44, pl. 19, fig. B (Kai Is., 129 fms [236 m]); DE BEAUFORT 1951:66–67, fig. 12

(after Günther); SMITH 1963:553, pl. 84/ (in part; after Günther); SUWARDJI 1965:308–310 (Kai Is., 180–290 m).

MATERIAL EXAMINED.—**Holotype:** BMNH 1879.5.14.565, 1 ♂, 128.6 mm SL, *Challenger* Exped., Kai Is.

**DIAGNOSIS.**—A *Callionymus* of the *kaianus*-group with a small branchial opening, a short head (about 4.6 in SL), preopercular spine with a small antrorse and two large curved points on dorsal side, straight distal margin of second dorsal fin, two short caudal fin filaments, long filamentous first spine of first dorsal fin, short main tip of preopercular spine, and pale anal fin.

**DESCRIPTION.**—Counts and measurements (see also Table 2):  $D_1$  IV;  $D_2$  viii,1; A viii,1; P<sub>1</sub> ii,17–18,ii; P<sub>2</sub> 1,5; C ii,2,ii,3,iii.

Body elongate and depressed. Head depressed, about 4.6 in SL. Eye large, 2.35 in head. Pupil relatively small, 3.3 in eye. Branchial opening of normal size, about two times in pupil. Occipital region with two low bony protuberances. Preopercular spine 1.45 in eye diameter, with a relatively short, slightly upcurved main tip, a small antrorse and two large curved points (the larger with a small additional basal point) on its dorsal side and a large antrorse spine at its base (formula:  $1-\overset{3}{-}1$ ; see Fig. 6B). Lateral line reaching from area behind eye to end of third branched caudal fin ray (seen

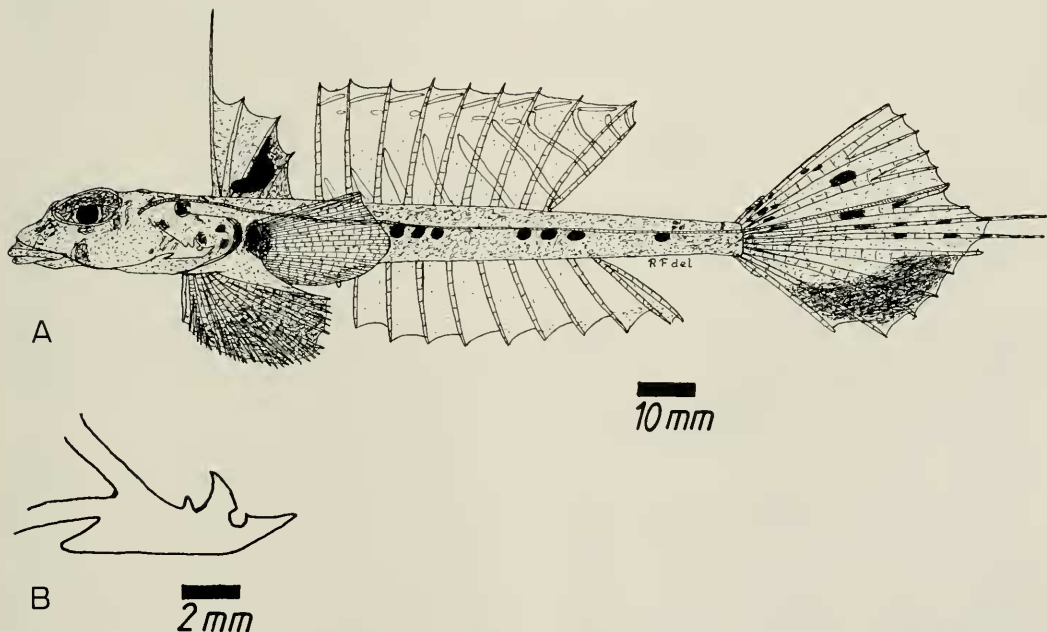


FIGURE 6. *Callionymus kaianus*, BMNH 1879.5.14.565, holotype, male, 128.6 mm SL, Kai Islands: (A) lateral view; (B) left preopercular spine.

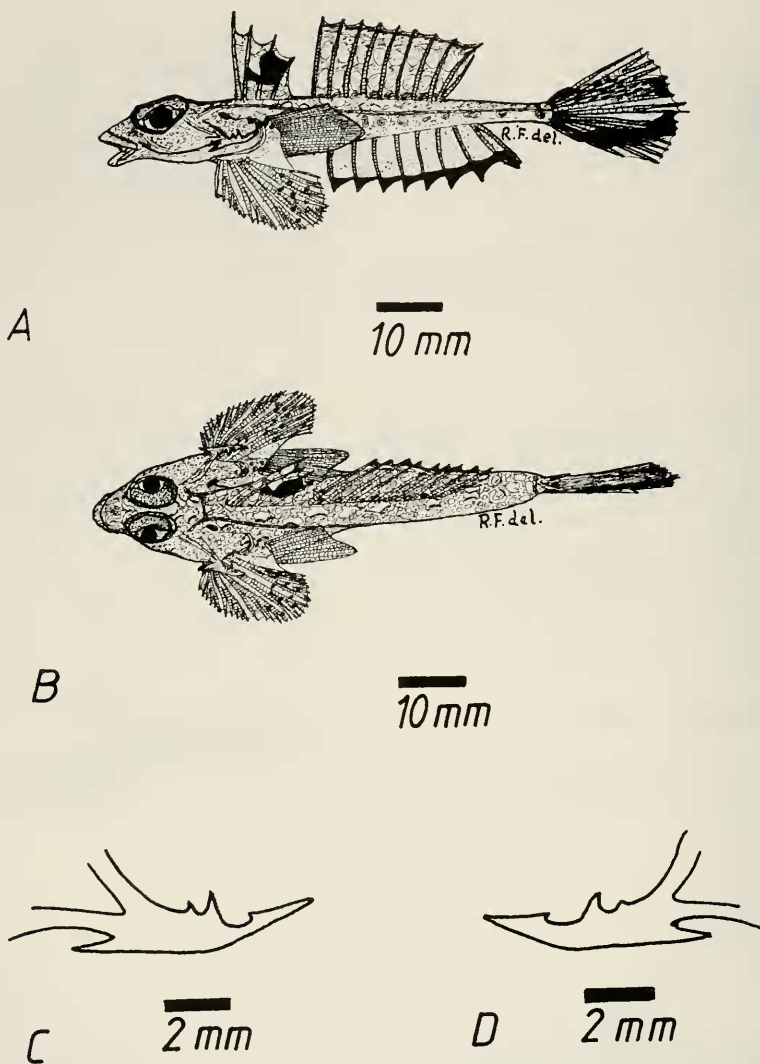


FIGURE 7. *Callionymus moretonensis*, NMB 37074, 69.4 mm SL, New Caledonia: (A) lateral view; (B) dorsal view; (C) left preopercular spine; (D) right preopercular spine.

from above); the line of one side is interconnected to its opposite member by a transverse branch across the occipital region and one across the dorsal side of caudal peduncle. Caudal peduncle length 5.2 in SL, minimal caudal peduncle depth 23.8 in SL.

First spine of first dorsal fin long and filamentous. Distal margin of second dorsal fin straight. Anal fin beginning on the vertical through mid-base of second membrane of second dorsal fin. Distal margin of caudal fin pointed, the two unbranched median rays filamentous (filaments rel-

atively short). Distal margin of pelvic fin convex; longest pelvic fin ray only reaching the anal papilla. Pectoral fin reaching to second anal fin ray when laid back.

Color in alcohol. Head and body light brown, back with some lighter blotches. Belly white, thorax brownish. Eye light gray. Pectoral fin base with a large dark blotch. A row of dark blotches in groups along body side. Operculum with some dark spots, head with indistinct brownish blotches and lines. First dorsal fin light, with a black blotch on third membrane, a

basal branch of which reaches nearly to second spine. Second dorsal fin colorless, with white lines in characteristic arrangement (see Fig. 6A). Anal fin colorless, with few yellow pigment on the membranes between the five posterior rays. Upper and median parts of caudal fin with dark spots and blotches; lower part with a broad curved dark band. Distal part of pelvic fin dark; pectoral fin colorless.

**DISTRIBUTION.**—Kai Islands (west of New Guinea), at three different localities (Fig. 1): 180–290 m, muddy bottom.

**DISCUSSION.**—*C. kaianus* differs from *C. moretonensis* of northern Australia, the species geographically nearest, by its shorter main tip of preopercular spine, and by various color markings (e.g., pale anal fin without a black distal margin); it differs from *C. whiteheadi* by the presence of filaments in the first dorsal and caudal fins, the barbed largest point on dorsal side of preopercular spine, and various color markings.

Specimens referred to *C. kaianus* from the Gulf of Thailand seem to belong to another species.

### *Callionymus moretonensis* Johnson, 1971

(Figure 7)

*Callionymus calauropomus*: (nec Richardson, 1844) PETERS, 1876:841 (New Ireland); JORDAN AND SEALE 1905:415 (after Peters); FOWLER 1928:422 (after Peters); MUNRO 1958:253 (after Peters).

*Callionymus kaianus moretonensis* JOHNSON, 1971:108–113, figs. 1–2 (s Queensland); 1973:217–230 (biology).

**MATERIAL EXAMINED.**—**Holotype:** AMS 115608–001, 1 spec., 158.3 mm SL, C. R. Johnson, 1 Aug. 1969, E of Cape Moreton, Queensland, 68–72 fms (124–132 m). **Paratypes:** CAS 24764, 1 spec., 131.2 mm SL; CAS 24765, 1 spec., 134.0 mm SL; CAS 24766, 1 spec., 141.7 mm SL; CAS 24767, 1 spec., 164.9 mm SL; all with same data as holotype.

Other specimens: BMNH 1892.1.14.26–27, 2 spec., 52.4–58.2 mm SL, Mr. Walker, Holothuria Banks (NW Australia). ZMB 9399, 1 ♂, 1 juv., 35.0–81.9 mm SL, R/V GAZELLE, "shortly before the year 1876," New Ireland. NMB 37074, 1 spec., 69.4 mm SL, P. Fourmanoir, 1979, Havannah, s New Caledonia, 150 m.

**DIAGNOSIS.**—A *Callionymus* of the *kaianus*-group with a small branchial opening; short head (3.4–4.7 in SL); preopercular spine with a small antrorse and two large curved points on its dorsal side and a long, slender main tip; second dorsal fin with a nearly straight distal margin; caudal fin with two short median filaments; first dorsal fin with a relatively long, filamentous first spine; anal fin with a dark distal margin; and

second dorsal fin with rows of white blotches and a dark distal margin.

**DESCRIPTION.**—Counts and measurements (see also Table 2): D<sub>1</sub> IV; D<sub>2</sub> viii, 1; A vii, 1–viii, 1; P<sub>1</sub> ii, 18–20; P<sub>2</sub> I, 5; C i–ii, 3–4, (0)–i–ii, 2–3, ii–iii.

Body elongate and depressed. Head depressed, about 3.4–4.7 in SL. Eye large, 2.0–2.4 in head. Pupil relatively small, 2.9–3.0 in eye. Branchial opening of normal size, about 2–3 times in pupil. Occipital region with two low bony protuberances. Preopercular spine about 1.1–1.2 in eye diameter, with a long slightly up-curved main tip, a small antrorse and two large curved points at its dorsal side, and a large antrorse spine at its base (formula:  $1\text{---}\overset{3}{\text{---}}1$ ; see Fig. 7C, D). Lateral line reaching from area behind eye to end of third branched caudal fin ray (counted from above); the line of the opposite side is interconnected by a transverse branch across the occipital region and one across the dorsal side of the caudal peduncle. Caudal peduncle length 5.8–6.5 in SL, minimal caudal peduncle depth 23.0–30.0 in SL.

First spine of first dorsal fin relatively long and filamentous (in adults). Distal margin of second dorsal fin straight. Anal fin beginning on a vertical through second ray of second dorsal fin. Distal margin of caudal fin convex in small specimens (somewhat pointed in adults), with two short median filaments. Distal margin of pelvic fin convex; longest pelvic fin ray reaching nearly to midbase of first membrane of anal fin. Pectoral fin reaching to fourth ray of second dorsal fin.

Color in alcohol. Head and body light brown, ventral side of body and belly whitish. Thorax white. Back with white spots bordered by semi-circular black lines. Eye grayish. A row of irregular brownish spots along sides of body. Head with small white spots. Some dark spots at upper part of pectoral fin base. First dorsal fin light brown, with a large black blotch on third membrane, a basal branch of which reaches to second spine, and some smaller white blotches surrounding it. Second dorsal fin with two or three rows of white spots and a darkish distal margin. Anal fin colorless, with a black distal border. Pelvic fin with small dark spots on distal parts of fourth and fifth rays. Pectoral fin colorless or with three vertical rows of darkish spots. Caudal fin whitish, with some dark spots forming a broad curved band in the upper part, a broad curved black band in the lower part.

**DISTRIBUTION.**—Northern half of Australia (Holothuria Banks to southern Queensland), New Caledonia, and New Ireland (see Fig. 1); 101–150 m, mud bottom.

**DISCUSSION.**—The differences between *C. kaianus* and *C. moretonensis* are discussed in the description of the former species. *Callionymus moretonensis* differs from *C. whiteheadi* by the presence of filaments in first dorsal and caudal fins, by the shape of the main tip of the preopercular spine, and by color markings.

The record of *Synchiropus calauropomus* (Richardson, 1844) from New Ireland (Peters 1876) is based on two specimens of *Callionymus moretonensis*. *Synchiropus calauropomus* does not occur in that area.

Johnson (1971) originally described *C. moretonensis* as a subspecies of *C. kaianus*, but the differences are sufficient to regard *C. moretonensis* as a distinct species.

### **Callionymus whiteheadi** new species

(Figure 8)

?*Callionymus kaianus*: (non Günther, 1880) WEBER 1913: (Madura Sea, 7°2.6'S, 115°23.6'E, 100 m).

**MATERIAL EXAMINED.**—**Holotype:** BMNH 1980.6.20.1, 112.3 mm SL, P. J. P. Whitehead, 14 July 1979, off Bali (8°50'S, 114°14'E), 110–220 m. **Paratype:** BMNH 1980.11.25.2, 1 spec., 105.5 mm SL, P. J. P. Whitehead, summer 1979, SE coast of Java (near type-locality).

**DIAGNOSIS.**—A *Callionymus* of the *kaianus*-group with a small branchial opening; short head (3.9–4.2 in SL); preopercular spine with a small antrorse and one or two large curved points, and a short main tip; second dorsal fin with a nearly straight distal margin; caudal fin with a convex distal margin, but without filaments; first dorsal fin without a filament and with a basal black blotch on third membrane; light brown cheeks with few dark spots; anal fin with a black distal margin; second dorsal fin with a basal row of dark spots; and sides of body with a row of distinct black blotches.

**DESCRIPTION.**—Counts and measurements (see also Table 1):  $D_1$  IV;  $D_2$  viii,1; A viii,1;  $P_1$  i–ii,15–17,ii;  $P_2$  1,5; C ii,3,i–ii,2–3,iii.

Body elongate and depressed. Head depressed, 3.9–4.2 in SL. Eye large, 2.2–2.3 in head. Pupil relatively small, about 3.2 in eye. Branchial opening of normal size, about 3 times in pupil. Occipital region with two low bony protuberances. Preopercular spine 1.7–1.9 in eye diameter, with a short, slightly upcurved main

tip, a small antrorse and one or two large curved points at its dorsal side, and a large antrorse spine at its base (formula:  $1-\overline{2-3}-1$ ; see Fig. 8B). Lateral line reaching from area behind eye to third branched caudal fin ray (counted from above); the line of the opposite side is interconnected by a transverse branch across the occipital region and another across the dorsal side of caudal peduncle. Caudal peduncle length 5.5–6.1 in SL, minimal caudal peduncle depth 25.5–26.3 in SL.

First spine of first dorsal fin somewhat longer than first ray of second dorsal fin, but not filamentous. Distal margin of second dorsal fin nearly straight. Anal fin beginning on the vertical through second ray of second dorsal fin. Distal margin of caudal fin convex; no median filaments. Distal margin of pelvic fin convex; longest pelvic ray only reaching to anal papilla when laid back. Pectoral fin reaching to midbase of second membrane of second dorsal fin when laid back.

Color in alcohol. Head and body dark olive-green; lower surface of body white. Back marbled with brown. Thorax and belly white. A dark area at upper part of pectoral fin base. Some large whitish spots bordered by black on operculum. Head with dark brown spots and lines. Eye dorsally black, ventrally dark blue. A row of irregular black blotches along sides of body. First dorsal fin olive-green; first spine marbled alternating black and white; a large black blotch basally on third membrane, a basal branch of which reaches to second spine. Second dorsal fin with two rows of indistinct darkish blotches and a basal row of distinct blackish blotches. Anal fin white, with a broad distal black margin. Caudal fin rays in upper part of caudal fin with black blotches; lower part of caudal fin blackish distally. Distal two-thirds of pelvic fin darkish; upper half of pectoral fin with four vertical rows of black spots.

**DISTRIBUTION.**—Bali and southeastern Java, possibly also Madura Sea (see Fig. 2); 110–220 m, mud bottom.

**DISCUSSION.**—The differences between *C. whiteheadi*, *C. kaianus*, and *C. moretonensis* have been discussed in the descriptions of the last two species. *C. whiteheadi* differs from *C. regani* by the shape of the preopercular spine and by various color markings (e.g., black border of anal fin; shape and position of black blotch in first dorsal fin; color patterns of second



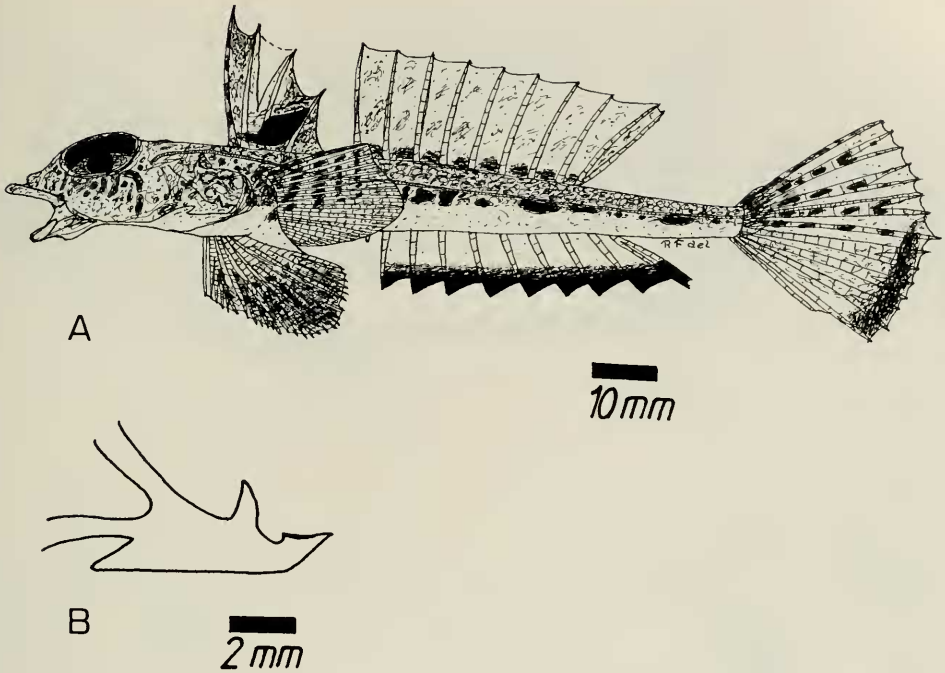


FIGURE 8. *Callionymus whiteheadi*, holotype, BMNH 1980.6.20.1, 112.3 mm SL, off Bali: (A) lateral view; (B) left preopercular spine.

dorsal and caudal fins; body color pattern, etc.). It differs from *C. guentheri* in lacking caudal fin filaments, in the different shape of the preopercular spine, and in various color markings.

**ETYMOLOGY.**—This new species is named after Dr. Peter J. P. Whitehead, British Museum (Natural History), who collected the type-specimens and allowed me to examine them.

### *Callionymus regani* Nakabo, 1979

(Figure 9)

*Callionymus kaianus*: (non Günther, 1880) REGAN 1908:248 (Saya de Malha Bank, 123 fms [225 m]); SMITH 1963 (part):553 (after Regan).

*Callionymus regani* NAKABO, 1979:231–234, fig. 1, table 1 (Saya de Malha Bank).

**MATERIAL EXAMINED.**—BMNH 1908.3.23.263, 1 ♂, 101.3 mm SL, Gardiner-Expedition, Saya de Malha Bank (western-central Indian Ocean), "over 123 fms" (225 m).

**DIAGNOSIS.**—A *Callionymus* of the *kaianus*-group with a small branchial opening; short head (about 4.1 in SL); preopercular spine with a small antrorse and two large curved points at dorsal side, and a short main tip; second dorsal fin with a nearly straight distal margin; caudal fin with a convex distal margin but without fil-

aments; first dorsal fin without a filament and with a distal black blotch on third membrane surrounded by white lines; dark brown cheeks with characteristic light blotches; colorless anal fin without a distal black margin; second dorsal fin with rows of white spots and lines; and sides of body with few large indistinct brownish blotches.

**DESCRIPTION.**—Counts and proportions (see Table 1):  $D_1$  IV;  $D_2$  viii,1; A viii,1;  $P_1$  i–iii,17–19,0–i;  $P_2$  1,5; C 0–ii,3,i–ii,2–3,ii–iii.

Body elongate and depressed. Head depressed, 4.1 in SL. Eye large, about 2.7 in head. Pupil relatively small, 3.4 in eye diameter. Branchial opening of normal size, about 3 in pupil. Occipital region with two low bony protuberances. Preopercular spine 1.4 in eye diameter, with a short, slightly upcurved main tip, a small antrorse and two larger curved points at its dorsal side, and a large antrorse spine at its base (formula:  $1-\frac{3}{-}1$ ; see Fig. 9B). Lateral line reaching from area behind eye to end of third branched caudal fin ray (seen from above); the line of the opposite side is interconnected by a transverse branch across the occipital region and another across the caudal peduncle. Caudal

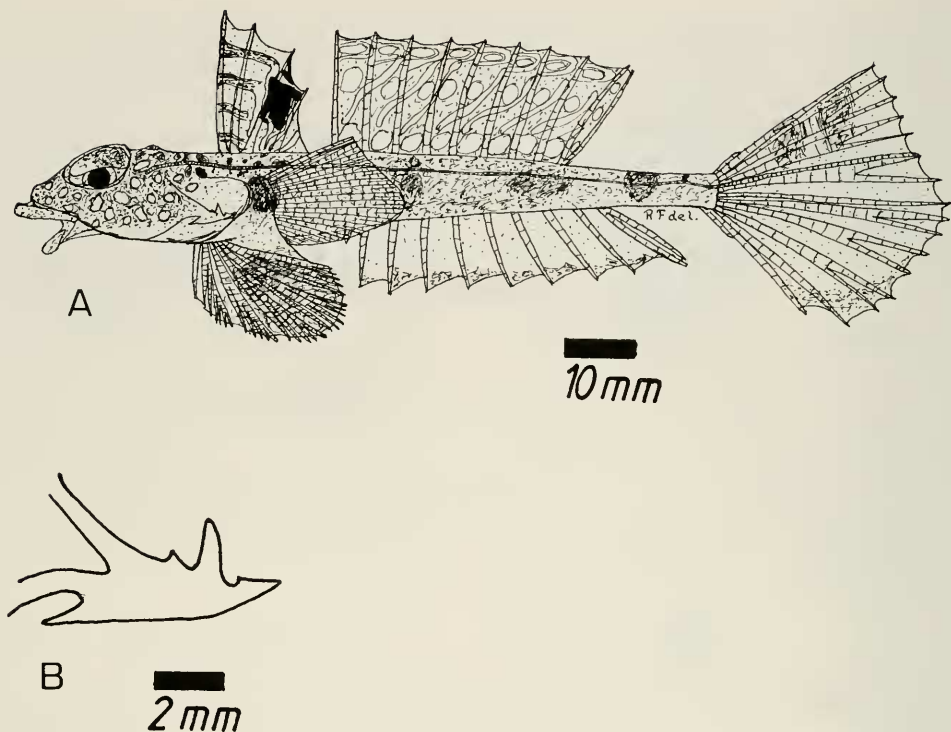


FIGURE 9. *Callionymus regani*, BMNH 1908.2.23.263, male, 101.3 mm SL, Saya de Malha Bank: (A) lateral view; (B) left preopercular spine.

peduncle length 6.25 in SL; minimal depth of caudal peduncle 22.5 in SL.

First spine of first dorsal fin somewhat longer than first ray of second dorsal fin, but not filamentous. Distal margin of second dorsal fin nearly straight. Anal fin beginning on vertical through second ray of second dorsal fin. Distal margin of caudal fin nearly convex; no median filaments. Distal margin of pelvic fin convex; longest pelvic fin ray reaching to base of first anal fin ray when laid back. Pectoral fin reaching to midbase of third membrane of second dorsal fin when laid back.

Color in alcohol. Head and body brown. Belly white, thorax light brown. Three to four large indistinct darkish areas along sides of body. Head brown; males with many light blotches, females with few light blotches. Occipital region with dark spots. Eye posteriorly gray, anteriorly yellowish. A large dark brown blotch at pectoral fin base. First dorsal fin pale; about four horizontal dark lines on first and second membranes.

A black blotch distally on third membrane, occasionally reaching to posterior part of second membrane; distal edge of third membrane also black. Remaining parts of third and fourth membranes covered with curved white lines. Second dorsal fin mostly colorless, with rows of white blotches and/or lines. Anal fin pale; distal margin yellowish. Caudal fin pale, occasionally with two darkish blotches at upper edge; lower part sometimes dusky. Distal parts of fourth and fifth rays of pelvic fin darkish; pectoral fin colorless.

**DISTRIBUTION.**—Saya de Malha Bank, western-central Indian Ocean (see Fig. 2); 126–225 m.

**DISCUSSION.**—The differences from *Callionymus whiteheadi* were discussed in the description of that species. *Callionymus regani* differs from *C. africanus* by the absence of caudal fin filaments and by a completely different color pattern; it differs from *C. kotthausi* in its shorter main tip of preopercular spine, shorter first spine of first dorsal fin, shorter caudal fin (especially

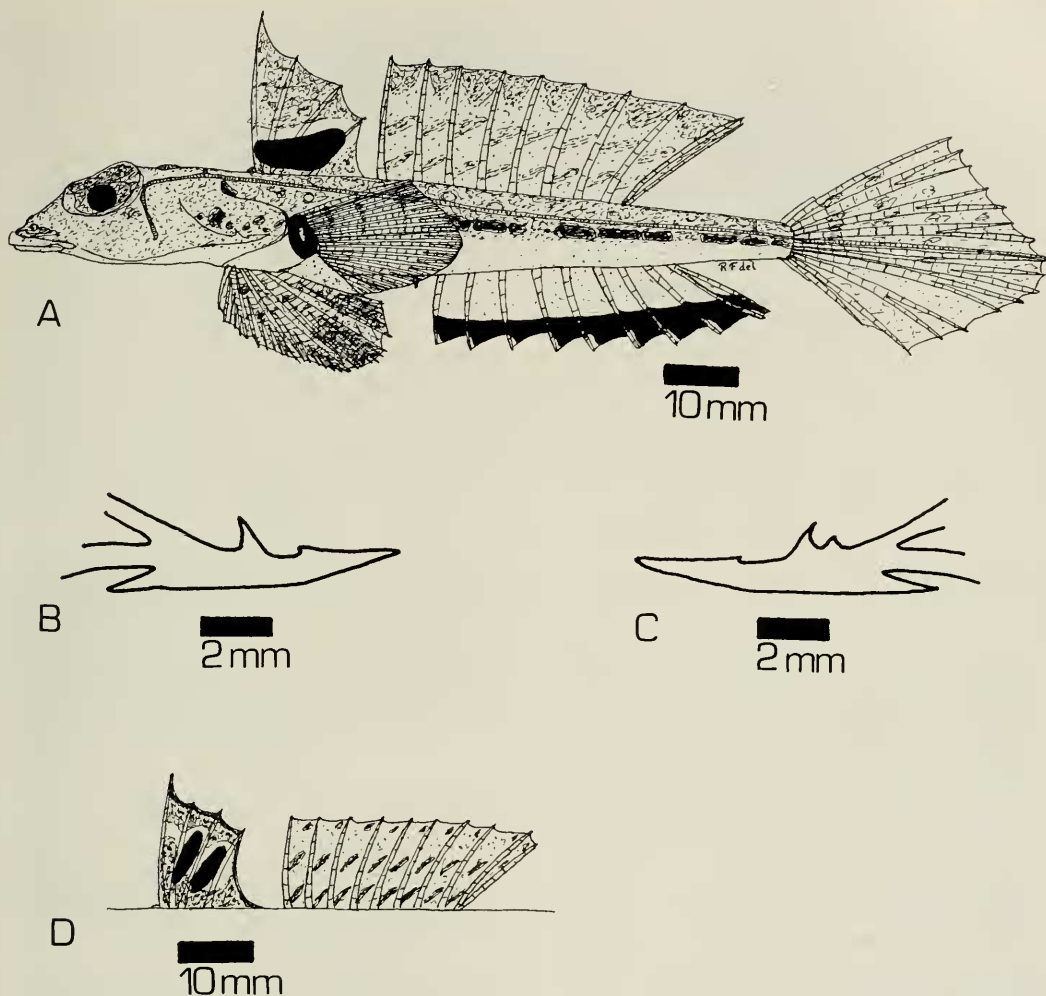


FIGURE 10. *Callionymus kotthausi*, ZIM 5535, holotype, 114.8 mm SL, off Cochin (India): (A) lateral view; (B) left preopercular spine; (C) right preopercular spine. ZIM 5536, paratype, specimen 1, male, 81.2 mm SL, Cochin; (D) first and second dorsal fins.

in males), and various color markings (e.g., color patterns of first and second dorsal fins, and anal fin, head, and sides of body).

#### *Callionymus kotthausi* new name

(Figure 10)

*Callionymus kaianus*: (non Günther, 1880) ALCOCK 1899:74 (Malabar Coast, India, 102 fms [187 m]).

*Diplogrammus indicus* KOTTHAUS, 1977:40–41, figs. 423b, 424b, 425 (wsw of Cochin, India).

**MATERIAL EXAMINED.**—**Holotype:** ZIM 5535, ♀, 114.8 mm SL, A. Kotthaus, R/V METEOR, 10 Feb. 1965, about 40 km wsw of Cochin, India (09°40'N, 75°38.8'E to 09°45.3'N,

75°38.5'E), 211–138 m. **Paratypes:** ZIM 5536, 2 ♂, 9 ♀, 71.3–87.0 mm SL; same data as holotype.

**DIAGNOSIS.**—A *Callionymus* of the *kaianus*-group with a small branchial opening; short head (3.8–4.1 in SL); preopercular spine with a small antrorse and one or two large curved points, and a long main tip; second dorsal fin with a nearly straight distal margin; caudal fin without filaments; anal fin with a broad dark margin; sides of body with a row of small distinct black blotches; and colorless lower part of caudal fin.

**DESCRIPTION.**—Counts and measurements

(see also Table 1):  $D_1$  IV;  $D_2$  viii,1; A viii,1;  $P_1$  i-ii,17,ii;  $P_2$  I,5; C ii,3,i,3,iii.

Body elongate, depressed. Head depressed, 3.8–4.1 in SL. Eye large, about 2.4 in head. Pupil about 2.8 in eye. Branchial opening of normal size, about 2–3 times in pupil. Occipital region with a low bony protuberance. Preopercular spine about 1.4 in eye diameter, with a long up-curved main tip, a small antrorse and one or two large curved points on its dorsal side, and a large antrorse spine at its base (formula  $1-\frac{2-3}{-}1$ ; see Fig. 10B,C). Lateral line reaching from area behind eye to end of median unbranched caudal fin ray, with a long branch at its ventral side in postorbital region; the line of the opposite side is interconnected by a transverse branch across the occipital region and another across the caudal peduncle. Caudal peduncle length about 6.5 in SL; minimal caudal peduncle depth about 24.0 in SL.

First spine of first dorsal fin long (longer than first ray of second dorsal fin), but not filamentous. Distal margin of second dorsal fin nearly straight. Anal fin beginning on the vertical through third ray of second dorsal fin. Distal margin of caudal fin convex or slightly pointed, without filaments. Distal margin of pelvic fin convex; longest pelvic fin ray reaching only to anal papilla when laid back. Pectoral fin reaching to middle of third membrane of second dorsal fin when laid back.

Color in alcohol. Head and dorsal side of body yellowish brown; back with some dark-edged whitish blotches. Sides of body with a row of dark spots. Thorax, belly, and lower parts of body yellowish white. Eye dark gray. Operculum with dark spots. First dorsal fin brownish; males with one or two black blotches surrounded by white on second and third membranes; females with an elongate ocellated basal black blotch on first to third membranes. Second dorsal fin transparent, distally darkish, with two rows of elongate dark spots. Distal margin of anal fin black, tips of rays white. Caudal fin mostly colorless, with 3–4 vertical rows of light brown spots in its upper part. Distal half of fourth and fifth pelvic fin rays dark; pelvic fin basally with irregular darkish spots.

DISTRIBUTION.—Southwest coast of India (see Fig. 2); 138–211 m.

DISCUSSION.—Kotthaus (1977) assigned *Diplogrammus indicus* to the genus *Diplogrammus*

using Smith's (1963:549) key: "A skinny keel along lower flank from tip of pelvic to caudal base," in combination with "an antrorse spine at base of preopercular spine." The latter feature is also valid for species of the genus *Callionymus*, but the specimens of "*Diplogrammus indicus*" have neither a skinny keel along lower flank of body, as in species of *Diplogrammus*, nor any other diagnostic feature of *Diplogrammus* (e.g., a free flap of skin at the operculum, a lateral line with many branches). Kotthaus's species belongs in the genus *Callionymus*, and it possesses all features of the *kaianus*-group of the subgenus *Callionymus*. The binomen *Callionymus indicus* (Kotthaus, 1977), however, becomes a secondary homonym of *Callionymus indicus* Linnaeus, 1758 (a *Platycephalidae* now well known as *Platycephalus indicus*) and must be replaced.

ETYMOLOGY.—The species is named after Dr. A. Kotthaus, who first described the species. In accordance with Dr. Kotthaus, who is presently unable to create a new name for the species because of his health, I propose the new name *Callionymus kotthausi* to replace *Callionymus indicus* (Kotthaus, 1977).

#### *Callionymus africanus* (Kotthaus, 1977)

(Figure 11)

*Callionymus kaianus*: (non Günther 1880) NORMAN 1939:73 (Zanzibar area); SMITH 1963 (part):553 (after Norman).

*Diplogrammus africanus* KOTTHAUS, 1977(part):38–40, figs. 421, 422, 423a, 424a (NE of Mombasa).

MATERIAL EXAMINED.—**Holotype**: ZIM 5533, ♀, 102.3 mm SL, A. Kotthaus, R/V METEOR, 14 Jan. 1965, about 180 naut. miles NE of Mombasa (01°18'S, 41°56'E to 01°19.8'S, 41°53'E). **Paratypes**: ZIM 5534, 11 ♂, 19 ♀, same data as holotype.

Other specimens: BMNH 1939.5.24.1422, 1 ♂, 75.5 mm SL, John Murray Exped., 12 Jan. 1934, near Zanzibar (5°38'54"S, 39°15'42"E to 5°40'18"S, 39°17'36"E); green mud bottom; bottom temperature 15.52°C; bottom salinity 35.21‰.

DIAGNOSIS.—A *Callionymus* of the *kaianus*-group with a small branchial opening; short head (about 4.0 in SL); preopercular spine with a small antrorse and two larger curved points at dorsal side, and a relatively short main tip; nearly straight distal margin of second dorsal fin; two short median caudal fin filaments; first dorsal fin without a filament and with a normal (not incised) second membrane; anal fin with a narrow black distal margin; no vertically elongated dark blotches in median part of caudal fin; back with



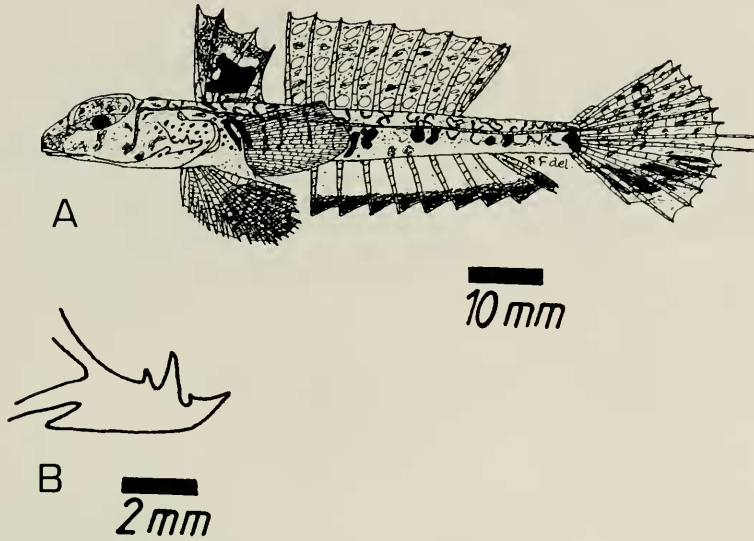


FIGURE 11. *Callionymus africanus*, BMNH 1939.5.24.1422, male, 75.5 mm SL, Zanzibar: (A) lateral view; (B) left preopercular spine.

dark-bordered light spots; and pectoral fin base with two transverse dark streaks.

DESCRIPTION.—Counts and proportions (see also Table 1):  $D_1$  IV;  $D_2$  viii,1; A viii,1;  $P_1$  i-ii,16-20,i-ii;  $P_2$  1,5; C ii,3,ii,2,iii.

Body elongate and depressed. Head depressed, 3.9-4.1 in SL. Eye large, 2.0-2.2 in head. Pupil relatively small, about 3.7 in eye diameter. Branchial opening of normal size, about 3 in pupil. Occipital region with two low bony protuberances. Preopercular spine 1.8 in eye diameter, with a short, slightly upcurved main tip, a small antrorse and two large curved points on its dorsal side, and a large antrorse spine at its base (formula:  $1-\overset{3}{-}-1$ ; see Fig. 11B). Lateral line reaching from area behind eye to end of third branched caudal fin ray (counted from above); the line of the opposite side is interconnected by a transverse branch across occipital region and another across dorsal side of caudal peduncle. Lateral line with a long branch at its ventral side behind eye. Caudal peduncle length 6.0-6.1 in SL, minimal caudal peduncle depth 19.9-21.3 in SL.

First spine of first dorsal fin somewhat longer than first ray of second dorsal fin, but not filamentous. Distal margin of second dorsal fin nearly straight. Anal fin beginning on the vertical through second ray of second dorsal fin. Distal

margin of caudal fin convex; males with two relatively short median filaments, females without filaments. Distal margin of pelvic fin convex; longest pelvic fin ray reaching to base of first anal fin ray when laid back. Pectoral fin reaching to fourth ray of second dorsal fin when laid back.

Color in alcohol. Head and body brown; ventral side of body lighter, belly and thorax white. A row of paired dark brown blotches on side of body. Back with light spots bordered with dark brown. Pectoral fin base with two transverse dark lines. Eye dark blue, dorsally with dark brown blotches. First dorsal fin brown; a large white-edged black blotch basally on third membrane, a basal and a distal branch of which reaches to second spine; occasionally, also with a small distal black blotch on third membrane. Second dorsal fin with three rows of white and two rows of darkish spots; these rows alternately arranged. Anal fin pale, with a narrow black distal margin. Lower part of caudal fin with a broad curved dark bar, upper part scattered with dusky spots. Distal parts of fourth and fifth pelvic fin rays dark; upper part of pectoral fin with three vertical rows of dark spots.

SEXUAL DIMORPHISM.—As described by Kotthaus (1977:40).

DISTRIBUTION.—Known from Zanzibar and southern Somalia (see Fig. 1), possibly distrib-

uted along entire east African coast; 212 m, mud bottom.

**DISCUSSION.**—The differences from *Callionymus regani* are discussed in the description of that species. The two paratypes described by Kotthaus (1977:39) from the southern Red Sea are small specimens of *Callionymus bentuviai*.

### *Callionymus bentuviai* new species

(Figure 12)

*Diplogrammus africanus* KOTTHAUS, 1977 (part):39 (S Red Sea).

**MATERIAL EXAMINED.**—**Holotype:** HUJF 9935, 87.8 mm SL, A. Ben-Tuvia, 1957, Eritrea (Ethiopia; S Red Sea). **Paratypes:** HUJF 8068, 2 spec., 79.7–85.2 mm SL, same data as holotype; ZIM 5532, 2 spec., 34.2–46.9 mm SL, A. Kotthaus, R/V METEOR, 6 Dec. 1964, S Red Sea, 70–75 m.

**DIAGNOSIS.**—A *Callionymus* of the *kaianus*-group with a small branchial opening; short head (3.6–4.0 in SL); preopercular spine with a small antrorse and two larger curved points at its dorsal side, and a relatively long main tip; second dorsal fin with a nearly straight distal margin; two very long median caudal fin filaments; first dorsal fin without a filament and with a deeply incised second membrane; and second dorsal fin with vertical dark streaks.

**DESCRIPTION.**—Counts and proportions (see also Table 1): D<sub>1</sub> IV; D<sub>2</sub> viii,1; A viii,1; P<sub>1</sub> i–ii,15–17,i–ii; P<sub>2</sub> 1,5; C ii,2–4,i–ii,2–3,ii–iii.

Body elongate and depressed. Head depressed, 3.6–4.0 in SL. Eye large, 2.15–2.85 in head. Pupil relatively small, about 2.7 in eye. Branchial opening of normal size, about 1.5 in pupil. Occipital region with two low bony protuberances. Preopercular spine 1.2–1.6 in eye diameter, with a long slightly upcurved main tip, a small antrorse and two larger curved points on its dorsal side, and a large antrorse spine at its base (formula:  $1-\overset{3}{-}1$ ; see Fig. 12C,D). Lateral line reaching from area behind eye to end of third branched caudal fin ray (counted from above); the line of the opposite side is interconnected by a transverse branch across occipital region and another across caudal peduncle. Caudal peduncle length 4.9–5.8 in SL, minimal caudal peduncle depth 23.1–24.9 in SL.

First spine of first dorsal fin longer than first ray of second dorsal fin, but not filamentous. Second membrane of first dorsal fin deeply incised (not in young specimens). Distal margin of second dorsal fin nearly straight. Anal fin beginning on the vertical through midbase of second

membrane of second dorsal fin. Distal margin of caudal fin convex, with two very long median filaments. Distal margin of pelvic fin mostly convex; longest ray reaching to middle of second membrane of anal fin when laid back. Pectoral fin reaching to fourth ray of second dorsal fin when laid back.

Color in alcohol. Head and body dark brown; ventral side of body dark brown, belly whitish. Back nearly monochromatic, with very few small dark spots. A row of small pale blotches along side of body, occasionally also a row of two groups of three dark spots each. Many black spots on operculum and at pectoral fin base. First dorsal fin light brown, with two darkish transverse lines distally between first and third spines. A large, elongate, curved black blotch basally from first to fourth spine, mainly on third membrane. Another black blotch distally on third membrane. Second dorsal fin pale, with nine vertical dark streaks. Anal fin dark brown, with a black distal margin. Caudal fin pale; dorsal part with a narrow curved dark line, ventral part with a broad curved dark bar. Pelvic fin pale; upper one-third with three vertical rows of dark spots.

**DISTRIBUTION.**—Known only from the southern Red Sea (see Fig. 2); 70–75 m.

**DISCUSSION.**—*Callionymus bentuviai* differs from all other species of the *kaianus*-group in its deeply incised second membrane of the first dorsal fin, the absence of a dorsal fin filament in combination with two very long median caudal fin filaments, and an unusual color pattern (e.g., in the dorsal fins).

**ETYMOLOGY.**—This species is named for Professor Adam Ben-Tuvia (Hebrew University of Jerusalem), who collected the holotype and sent it to me for examination.

### *Callionymus ochiai* new species

(Figure 13)

*Callionymus kaianus*: (non Günther, 1880) OCHIAI, ARAGA, AND NAKAJIMA 1955:111–113, figs. 8–10, table 6 (various S Japan localities); MATSUBARA 1955:713 (after Ochiai, Araga, and Nakajima); KAMOHARA 1964:90 (Kochi Pref. to Kagoshima; deep-sea bottom, very rare); MASUDA, ARAGA, AND YOSHINO 1975:261, pl. 84D (Kumano Bay south).

**MATERIAL EXAMINED.**—**Holotype:** FAKU 23261, ♂, 95.0 mm SL, 1–3 Sep. 1954, Shibushi, Kagoshima Pref., Japan. **Paratypes:** FAKU 23257–23260 and FAKU 23275, 2 ♂, 3 ♀, 77.8–116.8 mm SL, same data as holotype.

**DIAGNOSIS.**—A *Callionymus* of the *kaianus*-group with a small branchial opening; short head

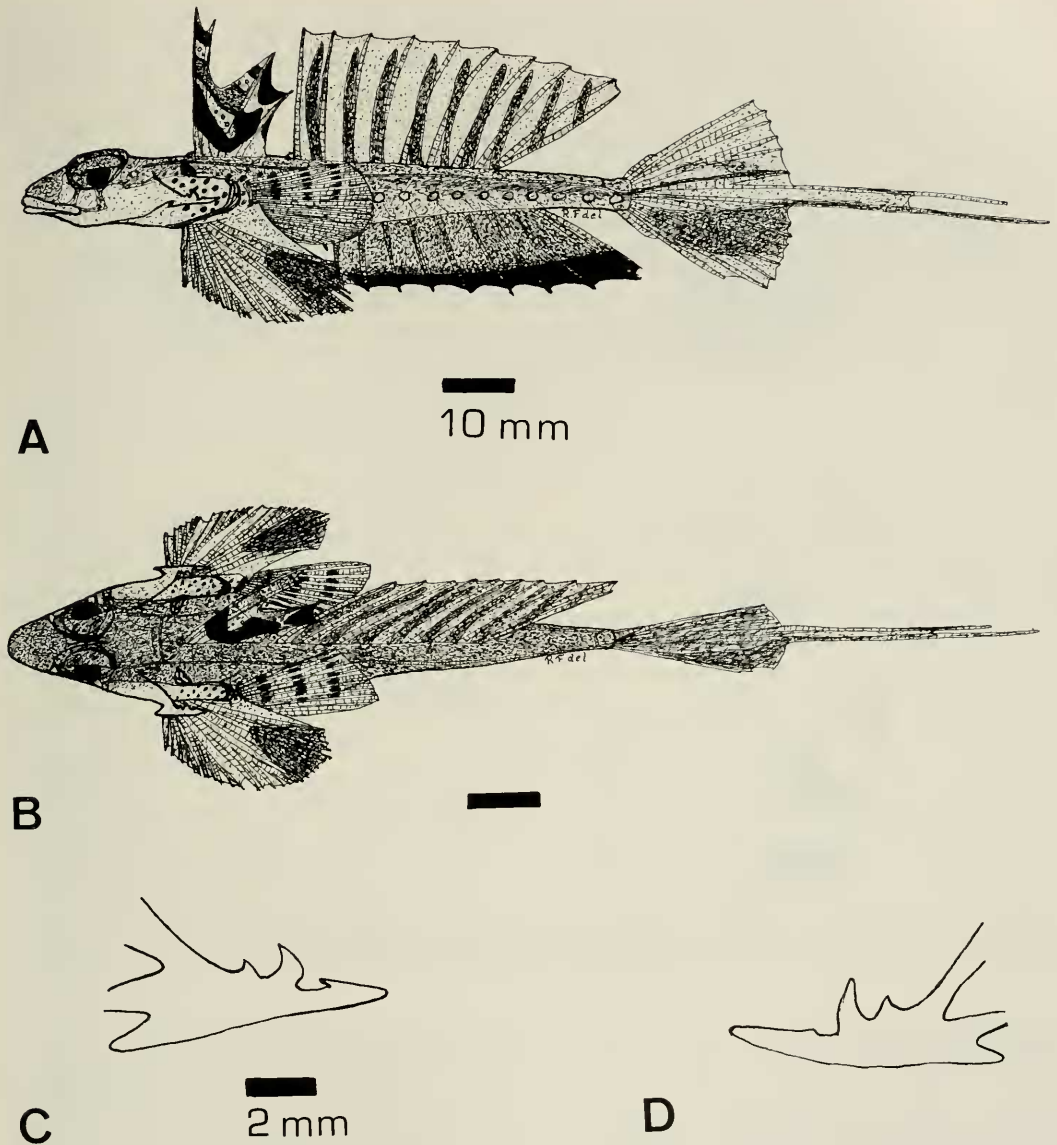


FIGURE 12. *Callionymus bentuviai*, HUJF 9935, holotype, 87.8 mm SL, Eritrea: (A) lateral view; (B) dorsal view; (C) left preopercular spine; (D) right preopercular spine.

(3.5–4.4 in SL); preopercular spine with a small antrorse and two larger curved points at its dorsal side, and a relatively long main tip; nearly straight distal margin of second dorsal fin; one or two short median caudal fin filaments; first dorsal fin with a long filament (males) or a filament of median size (females); anal fin without a distal dark margin; and long, slender main tip of preopercular spine, which is longer than the longest point on its dorsal edge.

DESCRIPTION.—Counts and proportions (see also Table 2):  $D_1$  IV;  $D_2$  viii, 1; A viii, 1;  $P_1$  ii, 16–18, i;  $P_2$  I.5; C ii, 3(–4), i, (2)–3, iii.

Body elongate and depressed. Head depressed, 3.5–4.4 in SL. Eye large, 2.3–3.0 in diameter. Pupil relatively small, about 3.65 in eye diameter. Branchial opening of normal size, about 2.5 in pupil. Occipital region with two low bony ridges. Preopercular spine 1.3–1.8 in eye diameter, with a long, slightly upcurved main

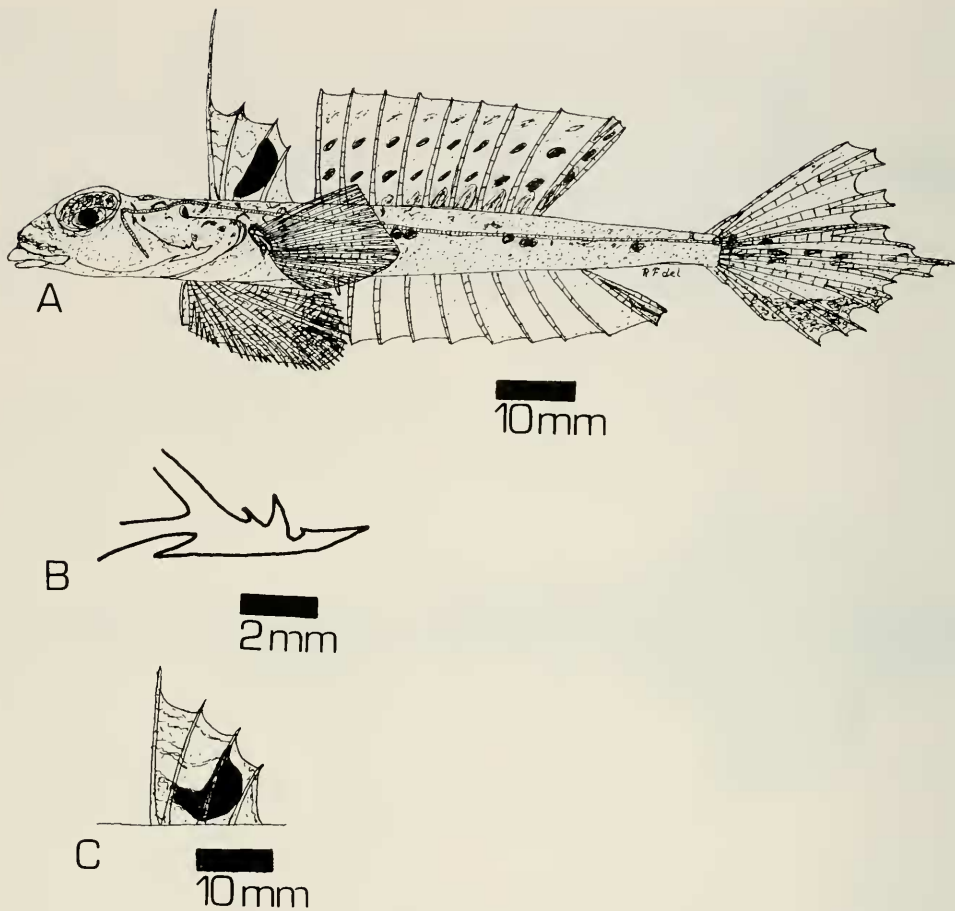


FIGURE 13. *Callionymus ochiaii*, holotype, FAKU 23261, male, 95.0 mm SL, Shibushi (Japan): (A) lateral view; (B) left preopercular spine. Paratype, FAKU 23258, female, 116.8 mm SL, Shibushi (Japan): (C) first dorsal fin.

tip, a small antrorse and two larger curved points at its dorsal side, and a large antrorse spine at its base (formula:  $1-\overset{3}{-}1$ ; see Fig. 13B). Lateral line reaching from area behind eye (from where a branch runs down to base of preopercular spine) to end of third branched caudal fin ray (counted from above); the line of the opposite side is interconnected by a transverse branch across occipital region and another across dorsal part of caudal peduncle. Caudal peduncle length 5.3–6.1 in SL; minimal caudal peduncle depth 24.3–27.8 in SL.

First spine of first dorsal fin filamentous (filament in females relatively short). Second membrane of first dorsal fin not incised. Distal margin of second dorsal fin nearly straight. Anal fin beginning on a vertical through midbase of second

membrane of second dorsal fin. Distal margin of caudal fin irregular, with two short median filaments. Distal margin of pelvic fin convex; longest pelvic fin ray reaching to midbase of first anal fin membrane. Pectoral fin reaching to fourth ray of second dorsal fin when laid back.

Color in alcohol. Body brownish yellow above, whitish below. Back with minute blackish spots, forming rings and blotches. A row of dark brown blotches along sides of body. Pectoral fin base with a dark area. Head with some irregular dark spots and blotches. First dorsal fin gray, with a black blotch basally or centrally on third membrane, a basal branch of which occasionally reaches to second spine. Second dorsal fin gray, with large irregular dark blotches and submarginal dark bands. Caudal fin pale ex-



cept for the darker lower part where the fin is scattered with several pale pearl-white round spots. Anal fin dusky, sometimes indefinitely but broadly edged with brown (but not with black). Pectoral fin uniformly pale; pelvic fin pale, outer posterior margin more or less dark.

**DISTRIBUTION.**—Southern Japan (see Fig. 1); about 100 m, sand and mud bottoms.

**DISCUSSION.**—From the most similar species, *C. moretonensis*, *C. ochiaii* differs in having a somewhat shorter main tip of preopercular spine, an irregular distal margin of caudal fin, and several different color markings (especially the absence of a distal black band in the anal fin; the color patterns of the caudal and second dorsal fins and of the pectoral fin base; the body color pattern, etc.). *Callionymus ochiaii* differs from *C. kaianus* in the shape of the largest point on the dorsal side of the preopercular spine, in the length of the filament in the first dorsal fin, and in various color markings.

The first dorsal fin filament of the male specimen figured in Ochiai, Araga, and Nakajima (1955:fig. 8) is very short. Because the specimen (91.0 mm SL) is nearly as long as the holotype (95.0 mm SL), the filament might have been broken in that specimen.

**ETYMOLOGY.**—This new species is named for Dr. Akira Ochiai, who first described the species under the name *Callionymus kaianus*.

### *Callionymus formosanus* new species

(Figure 14)

?*Callionymus kaianus*: (non Günther, 1880) CHU 1957:22 (Pescadores Islands).

**MATERIAL EXAMINED.**—**Holotype:** CAS 46972, ♂, 104.0 mm SL, F. B. Steiner, Apr. 1971, Formosa Str. (25°N, 120°E), approximately 90 m.

**DIAGNOSIS.**—A *Callionymus* of the *kaianus*-group with a small branchial opening; short head (about 4.5 in SL); preopercular spine with a small antrorse and two larger curved points at dorsal side; relatively high second dorsal and anal fins with convex distal margins; filamentous first spine of first dorsal fin; large black blotch nearly on entire third membrane of first dorsal fin; anal fin with a distal black streak on each membrane; distal two-thirds of anal fin brown; and white anal fin ray tips.

**DESCRIPTION.**—Counts and proportions of the holotype (see also Table 2): D<sub>1</sub> IV; D<sub>2</sub> viii,1; A viii,1; P<sub>1</sub> ii,16–17,ii; P<sub>2</sub> I,5; C ii,3,ii,2,iii.

Body elongate and depressed. Head de-

pressed, about 4.5 in SL. Eye large, about 2.3 in head. Pupil relatively small, about 3.4 in eye diameter. Branchial opening of normal size, about 2.5 in pupil. Occipital region with two low bony ridges. Preopercular spine about 1.7 in eye diameter, with a slightly upcurved main tip of medium size, a small antrorse and two larger curved points at its dorsal side, and a large antrorse spine at its base (formula:  $1-\frac{3}{-}-1$ ; see Fig. 14B). Lateral line reaching from area behind eye (from where a long branch runs downwards) to middle of upper median unbranched caudal fin ray; the line of the opposite side is interconnected by a transverse branch across occipital region and another across dorsal side of caudal peduncle. Caudal peduncle length 4.9 in SL, minimal caudal peduncle depth 13.0 in SL.

First spine of first dorsal fin filamentous. Second dorsal fin relatively high, distal margin convex. Anal fin beginning on a vertical through midbase of first membrane of second dorsal fin. Distal margin of caudal fin convex, with one relatively long filament. Distal margin of pelvic fin convex; longest pelvic fin ray reaching to midbase of first membrane of anal fin. Pectoral fin reaching to third ray of second dorsal fin when laid back.

Color in alcohol. Body dark brown, belly whitish. Side of body with a row of irregular blackish blotches. Head dark brown, with some lighter spots. A vertical dark streak under the eye. A dark blotch at pectoral fin base. Back and sides of body with whitish dark-edged blotches. First dorsal fin pale, with a large dark blotch on third membrane and three white blotches on first and second membranes. Second membrane with a distal black margin. Second dorsal fin pale, with a vertical white streak on each fin ray. Distal margin of first three rays of second dorsal fin black. Anal fin pale, distal two-thirds brownish, with a distal black streak on each membrane; tips of fin rays white. Caudal fin pale, with a vertical row of dark spots; lower margin and lower distal margin dark. Pelvic fin with irregular darkish spots and a dark distal margin of third, fourth, and fifth rays. Upper part of pectoral fin with three vertical rows of dark spots.

**DISTRIBUTION.**—Known only from Formosa Strait (see Fig. 2); about 90 m.

**DISCUSSION.**—This interesting new species belongs to the subgroup of species with a high second dorsal fin in the *kaianus*-group. It seems

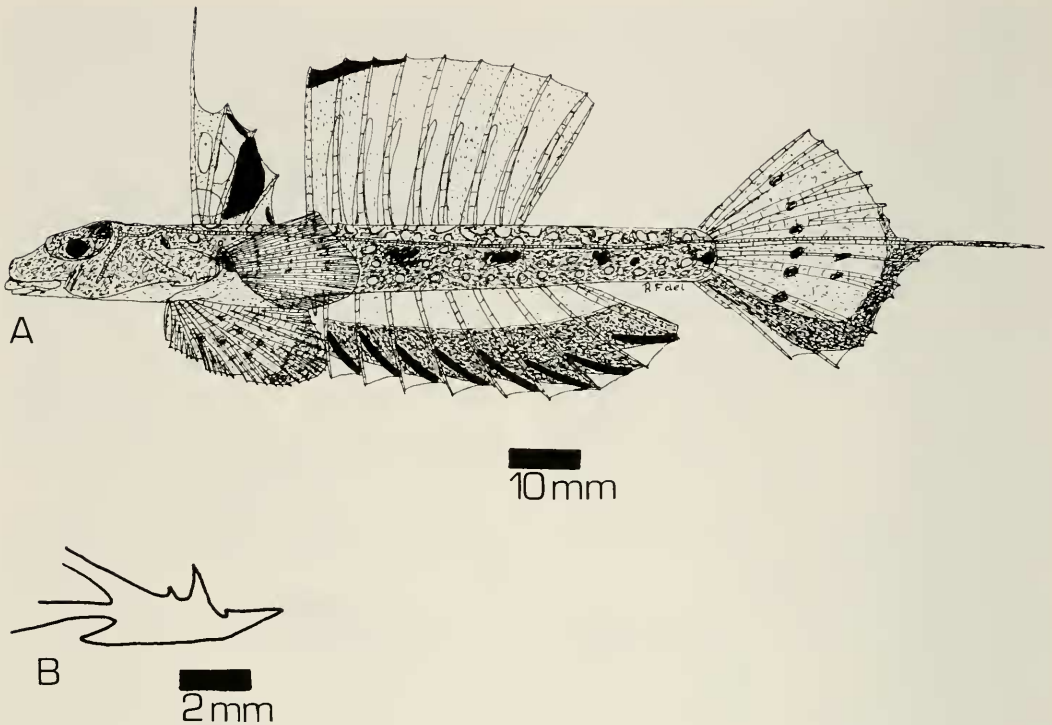


FIGURE 14. *Callionymus formosanus*, holotype, CAS 46972, male, 104.0 mm SL, Formosa Strait: (A) lateral view; (B) left preopercular spine.

to be a primitive member of that subgroup because the second dorsal fin is still relatively low.

The specimen recorded as *Callionymus kaianus* by Chu (1957) from Pescadores Islands (southern part of Formosa Strait) is probably this species.

**ETYMOLOGY.**—This new species is named after its type-locality (Formosa Strait).

### *Callionymus guentheri* new species

(Figures 15–17)

*Callionymus curvicornis*: (non Valenciennes, 1837) GÜNTHER 1880: 53 (Philippines, 82 fms [150 m]); HERRE 1953:777 (after Günther).

**MATERIAL EXAMINED.**—**Holotype:** BMNH 1879.5.14.567, ♀, 87.3 mm SL, CHALLENGER Exped., 26 Oct. 1874, w of Zamboanga, Philippine Is. (7°03'N, 121°48'E; entrance from Sulu Sea into Basilan Str., about 7 miles w of Mindanao I., and to the NW of Caldera Pt.), 82 fms (150 m). **Paratypes** (all from the Philippines collected by J. E. Norton, 1966): CAS 46966, 4 spec., 3 Nov., Sandoval Pt., Catanauan, Quezon, 70–78 fms (128–143 m); CAS 32897, 11 spec. (7 ♂, 4 ♀), 51.2–128.0 mm SL, 27 June, Lemery Town, Balayan Bay, Batangas, Luzon, 90–85 fms (165–155 m); CAS 33879, 1 ♀, 112.8 mm SL, 15 Dec., N of San Andres I., Marinduque, 151–158 fms (276–289 m); CAS 34286, 3 ♂, 100.0–108.3 mm SL, 14

Dec., NW of San Andres I., Marinduque, 137–139 fms (250–254 m); CAS 34197, 1 ♂, 8 ♀, 90.2–129.3 mm SL, 24 Nov., Siburio Pt., Ragay Gulf, Camarines Sur Prov., 319–324 fms (583–593 m); CAS 32905, 4 ♂, 3 ♀, 69.3–117.2 mm SL, 15 Nov., Buri Pt., Ragay Gulf, Camarines Sur Prov., 304–309 fms (556–566 m); CAS 34426, 1 ♀, 84.1 mm SL, 4 July, s of Bauan Town, Batangas Bay, Batangas Prov., 90–88 fms (165–161 m); CAS 34278, 4 ♀, 89.9–124.5 mm SL, 11 Dec., N of Melchor I., Marinduque, 120–126 fms (219–231 m); CAS 33864, 3 ♀, 90.0–127.3 mm SL, 23 Nov., Caurusan Pt., Ragay Gulf, Camarines Sur Prov., 302–308 fms (552–564 m); CAS 32916, 5 ♀, 91.0–118.2 mm SL, 11 Nov., Pusgo Pt., Ragay Gulf, Quezon, Luzon I., 60–67 fms (110–123 m); CAS 33703, 1 ♀, 122.0 mm SL, 25 June, s of Barrio Nomong Casto, Balayan Bay, 105–100 fms (183–192 m); CAS 34401, 1 ♀, 117.7 mm SL, 24 June, SE of Calaca Town, Balayan Bay, 65–55 fms (119–100 m); CAS 32997, 1 ♀, 107.5 mm SL, 15 June, Batangas, Balayan Bay, s of Barrio Sinisian, 95–99 fms (174–181 m); CAS 34190, 1 ♂ (113.2 mm SL), 1 ♀ (99.7 mm SL), 6 Nov., SE of Alibijaban I., Ragay Gulf, 81–88 fms (148–161 m); CAS 34272, 1 ♂, 108.0 mm SL, 14 Nov., Nagas Pt., Ragay Gulf, 297–299 fms (543–547 m); CAS 34154, 7 ♀, 91.1–129.2 mm SL, 3 Sep., N of San Andres Pt., Marinduque, 108–112 fms (197–205 m); CAS 32668, 2 ♀, 94.5–102.0 mm SL, 26 July, SE of Talaga, Batangas Bay, 138–131 fms (253–240 m); CAS 32801, 1 ♂, 91.9 mm SL, 25 Aug., NE of Salomague I., Marinduque, 142–150 fms (260–275 m); CAS 34205, 1 ♀, 127.0 mm SL, 10 Dec., NW of Baltazar I., Marinduque, 142–150 fms (260–275 m); CAS 34468, 1 ♀, 102.8 mm SL, 27 July, Lemery

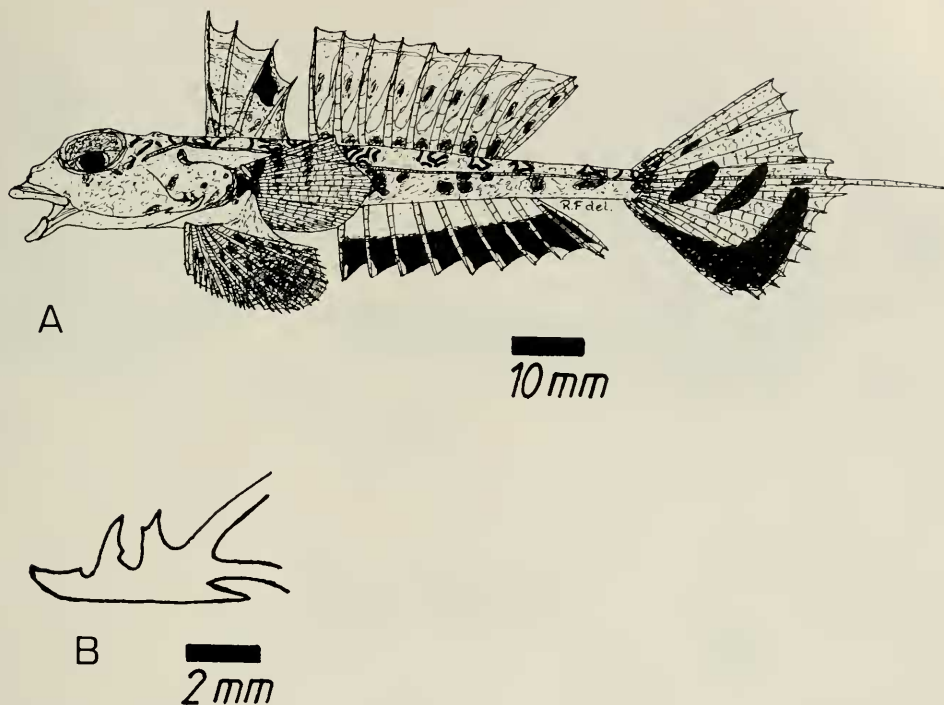


FIGURE 15. *Callionymus guentheri*, holotype, BMNH 1879.5.14.567, female, 87.3 mm SL, off Zamboanga, Philippines: (A) lateral view; (B) left preopercular spine.

Town, Balayan Bay, 85–90 fms (155–164 m); CAS 34074, 1 ♀, 123.2 mm SL, n of Sayao Bay, Marinduque, 61–70 fms (111–128 m); CAS 33067, 1 ♀, 125.2 mm SL, 18 July, s of Barrio Salong, Luzon I., 120–114 fms (220–208 m).

**DIAGNOSIS.**—A *Callionymus* of the *kaianus*-group with a small branchial opening; short head (3.9–4.2 in SL); preopercular spine with a small antrorse and two larger curved points on dorsal side; very high second dorsal fin with a convex distal margin (males) or a relatively low second dorsal fin with a nearly straight distal margin (females); first dorsal fin without a filament (or with a very short one in smaller specimens); long and slender main tip of preopercular spine; anal fin with a black distal half and white fin ray tips; regular distal margin of caudal fin, with filaments only in small specimens (caudal fin elongate in adults); and relatively large central black blotch on third membrane of first dorsal fin.

**DESCRIPTION.**—Counts and proportions of the holotype (female) (see also Table 2):  $D_1$  IV;  $D_2$  viii,1; A viii,1;  $P_1$  i–ii,17–19,i–ii;  $P_2$  1,5; C ii,2–3,i–ii,2–4,iii.

Body elongate and depressed. Head depressed, 3.9–4.2 in SL. Eye large, 2.3–2.6 in

head. Pupil of normal size, 2.7–3.5 in eye diameter. Branchial opening of normal size, about 2.0 in pupil. Occipital region with two low bony ridges. Preopercular spine 1.5–1.7 in eye diameter, with a slightly upcurved main tip which is relatively long or of medium size, a small antrorse and two larger curved points on its dorsal side, and a large antrorse spine at its base (formula:  $1-\overset{3}{-}1$ ; see Fig. 15B, Fig. 16B). The two large spines on the dorsal side of the preopercular spine of the holotype possess small basal hooks (see Fig. 15B). Lateral line usually reaching from area behind eye to end of third branched caudal fin ray (counted from above); because of the different caudal fin formula of the holotype (C ii,2,i,4,iii instead of C ii,3,ii,2,iii), the lateral line reaches to middle of median unbranched caudal fin ray in that specimen. The lateral line of the opposite side is interconnected by a transverse branch across occipital region and another across dorsal side of caudal peduncle. Caudal peduncle length 5.1–6.0 in SL, minimal caudal peduncle depth 23.0–26.0 in SL.

First spine of first dorsal fin somewhat longer than first ray of second dorsal fin but not fila-

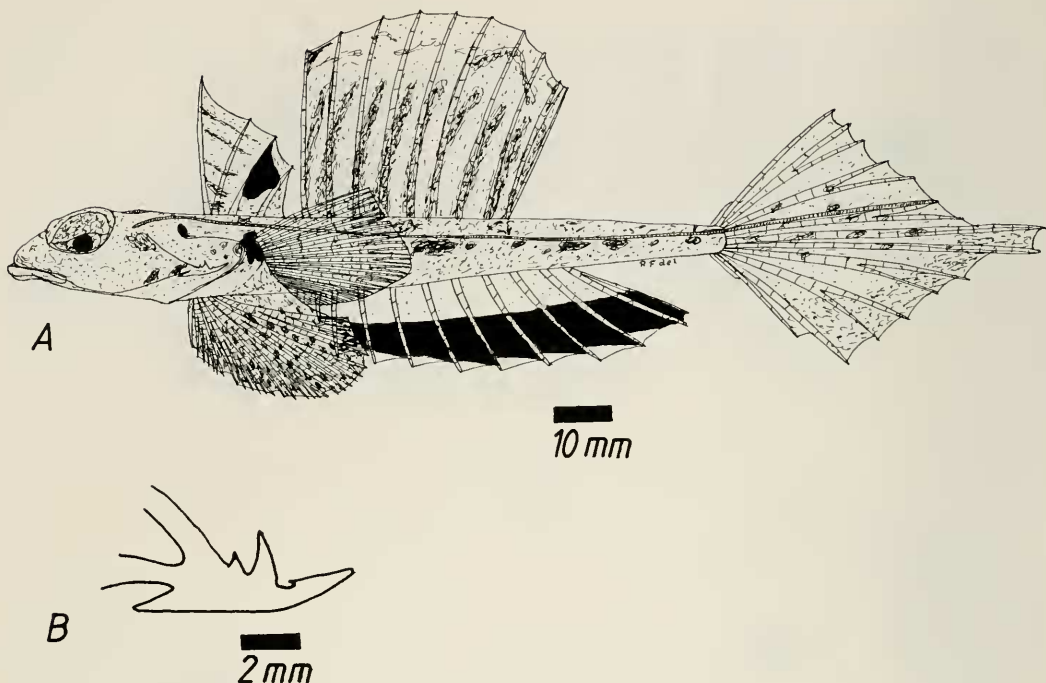


FIGURE 16. *Callionymus guentheri*, paratype, CAS 32897 (specimen 1), male, 128.0 mm SL, Balayan Bay, Philippines: (A) lateral view; (B) left preopercular spine.

mentous (only occasionally in small specimens a very short filament). Second dorsal fin in males relatively high, with a convex distal margin, in females lower, with a nearly straight distal margin. Anal fin beginning on the vertical through base of second ray of second dorsal fin. Distal margin of caudal fin in small specimens convex, with one or two long filaments; in larger specimens all median caudal fin rays elongate (the two median rays longest), but not filamentous; even the longest rays are connected by membranes. Distal margin of pelvic fin convex; longest pelvic fin ray reaching to midbase of first or second membrane of anal fin. Pectoral fin reaching to fourth or fifth ray of second dorsal fin when laid back.

Color in alcohol. Head and body brown. One or two rows of large, irregular dark blotches along side of body. A large dark area on pectoral fin base. Back with dark brown semicircular lines in groups which are bordered by white on one side. Eye dark gray. Belly and thorax white; lower side of body brown. Head with few irregular darkish spots. First dorsal fin light brown,

with five brownish cross-lines in the anterior part; a dark blotch on third membrane distally or centrally. Second dorsal fin pale, females with a basal and a median row of dark spots and some curved white lines (see Fig. 15A); males with vertical darkish streaks (see Fig. 16A). Distal half of anal fin black; tips of fin rays white. Caudal fin in females with a broad dark band in the lower and lower distal parts and two median short transverse dark bands; in the upper part some irregular dark spots. Males have the same caudal fin color pattern, but less intense. Pectoral fin dorsally with two rows of dark spots. Distal three-fourths of pelvic fin darkish, with irregular dark brown spots and blotches.

DISTRIBUTION.—Known from various localities in the Philippine Islands (southern coast of Luzon to northern coast of Mindanao; see Fig. 2); 100–593 m, on mud bottoms.

DISCUSSION.—The differences between *C. guentheri*, *C. whiteheadi*, and *C. kaianus* have been discussed in the descriptions of the last two species. *Callionymus guentheri* differs from *C. regani* in the caudal fin shape, the high second



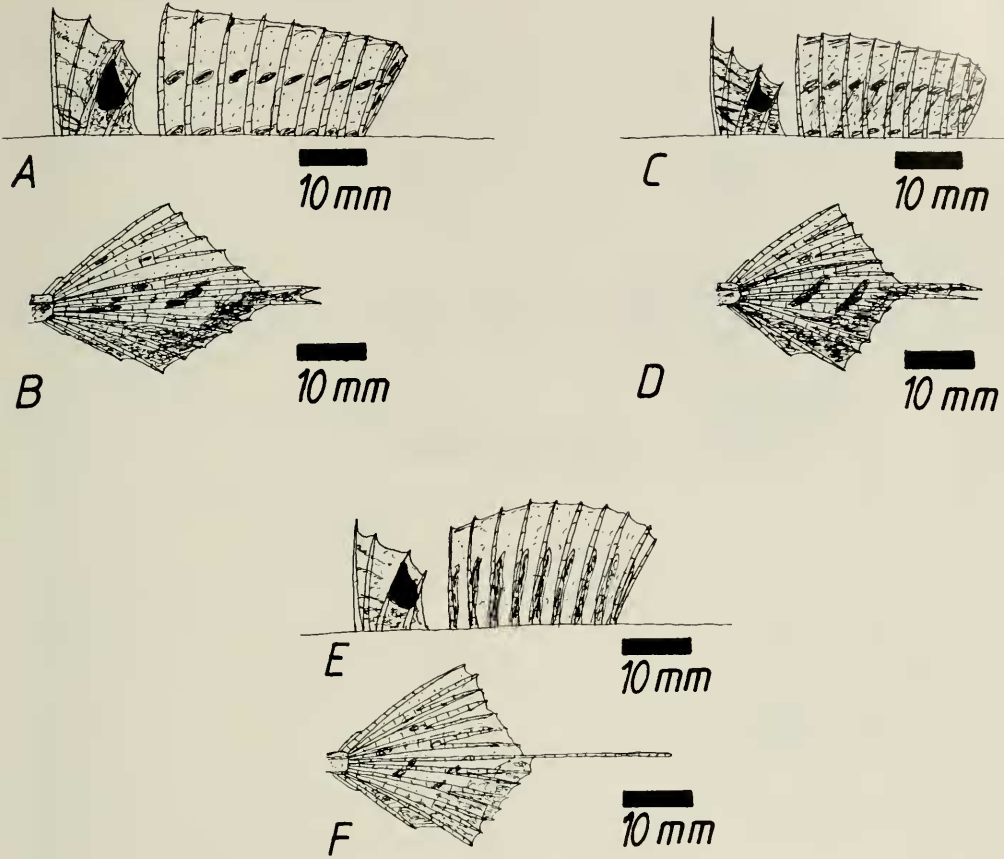


FIGURE 17. *Callionymus guentheri*, paratypes, CAS 32897, Balayan Bay, Philippines. Female (specimen 2), 108.8 mm SL: (A) first and second dorsal fins; (B) caudal fin. Male (specimen 4), 77.6 mm SL: (C) first and second dorsal fins; (D) caudal fin. Male (specimen 10), 85.3 mm SL: (E) first and second dorsal fins; (F) caudal fin.

dorsal fin (in males), and various color markings; from *C. ochiaii* in the caudal fin shape, the lack of a dorsal fin filament (in males), the high second dorsal fin (in males), and several color markings.

In the extensive collections of J. E. Norton (paratypes of *C. guentheri*), a great depth range can be found (100–593 m); 593 m is the greatest depth recorded for any species of the *kaianus*-group. Because few specimens are known of most species of that group, it is possible that in the future, specimens of other species will be recorded from comparable depths.

**ETYMOLOGY.**—This new species is named after Dr. Albert Günther, who, in 1880, reported the first specimen under the name *Callionymus curvicornis*.

### *Callionymus altipinnis* new species

(Figure 18)

*Callionymus kaianus*: (non Günther, 1880) CHU ET AL. 1962:723–724, fig. 585 (South China Sea); BESEDNOV 1968:63 (Gulf of Tonkin).

*Callionymus huguenini*: (non Bleeker, 1858) SHEN 1964:202–203, fig. 2 (Hong Kong).

**MATERIAL EXAMINED.**—**Holotype:** MSL 0001, ♂, 123.8 mm SL, S.-C. Shen, Hong Kong Fish Market. **Paratypes:** CAS 46967, 10 spec., 104.1–144.5 mm SL, R. L. Bolin, 23 July 1958, South China Sea, E of Hainan (20°32'N, 112°45'30"E); CAS 46968, 1 spec., 135.9 mm SL, R. L. Bolin, 21 July 1958, off Tungku Pt., Hainan (19°31'N, 111°24'30"E); CAS 46969, 1 spec., 124.8 mm SL, R. L. Bolin, 23 July 1958, South China Sea, E of Hainan (20°32'N, 112°51'E).

**DIAGNOSIS.**—A *Callionymus* of the *kaianus*-group with a small branchial opening; short head (about 4.2 in SL); preopercular spine with a rel-

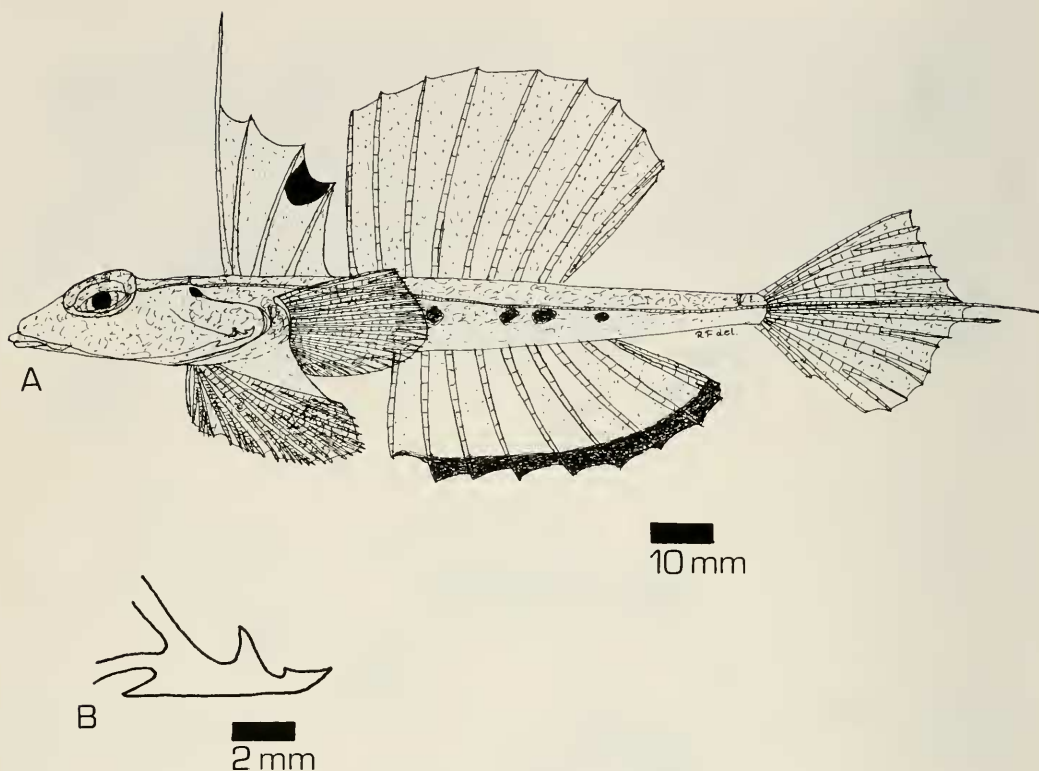


FIGURE 18. *Callionymus altipinnis*, holotype, MSL 0001, male, 123.8 mm SL, Hong Kong: (A) lateral view; (B) left preopercular spine.

atively short main tip; small antrorse and one (rarely two) larger curved points at dorsal side; very high second dorsal and anal fins with convex distal margins; filamentous first spine of first dorsal fin; small distal black blotch on third membrane of first dorsal fin; anal fin with a black distal margin (including tips of fin rays), but without a distal black streak on each membrane surrounded by dark brown; and one or two caudal fin filaments of medium size.

DESCRIPTION.—Counts and proportions of the holotype (see also Table 2):  $D_1$  IV;  $D_2$  viii,1; A viii,1;  $P_1$  i,14–15,ii;  $P_2$  1.5; C i,3,ii,3,ii.

Body elongate and depressed. Head depressed, about 4.2 in SL. Eye large, about 2.5 in head. Pupil of normal size, about 3.8 in eye. Branchial opening about 3 in pupil. Occipital region with two low bony ridges. Preopercular spine about 1.7 in eye diameter, with a relatively short, slightly upcurved main tip, a small antrorse and one (rarely two) larger points on its dorsal side, and a large antrorse spine at its base

(formula:  $1\overline{2(-3)}1$ ; see Fig. 18B). Lateral line reaching from area behind eye to middle of upper median unbranched caudal fin ray; the line of the opposite side is interconnected by a transverse branch across occipital region and another across dorsal side of caudal peduncle. Caudal peduncle length about 5.0 in SL; minimal caudal peduncle depth about 25.0 in SL.

First spine of first dorsal fin filamentous. Second dorsal fin very high, distal margin convex. Anal fin begins on vertical through middle of second membrane of second dorsal fin. Distal margin of pelvic fin convex; longest pelvic fin ray reaching nearly to base of first anal fin ray. Pectoral fin reaching to middle of third membrane of second dorsal fin when laid back. Distal margin of caudal fin somewhat pointed, with one or two filaments.

Color in alcohol. Head, body, and fins pale except for a distal black blotch on third membrane of first dorsal fin, a row of dark blotches along side of body, eyes grayish, a black distal

margin of anal fin, and a darkish area on pectoral fin base.

**DISTRIBUTION.**—Known only from the South China Sea off China, from Hong Kong (type-locality) to the Gulf of Tonkin; island of Hainan (see Fig. 2). The exact collecting depth of specimens of *C. altipinnis* is not known, but the species should occur at about the same depth as other species of the *kaianus*-group.

**DISCUSSION.**—*Callionymus altipinnis* differs from *C. sokonumeri* in the filamentous first spine of the first dorsal fin, the shorter caudal fin filaments, and various color markings.

The record of *C. huguenini* Bleeker (by Shen 1964) from Hong Kong is based on a misidentified specimen of *C. altipinnis* (the specimen is now the holotype of *C. altipinnis*).

**ETYMOLOGY.**—From the Latin *altus*, high, and *pinna*, fin, in reference to the unusually high second dorsal, anal, and first dorsal fins.

#### *Callionymus sokonumeri* Kamohara, 1936

*Callionymus sokonumeri* KAMOHARA, 1936:448, fig. 2 (Mimase Market); 1952:90, fig. 87 (Prov. Tosa); 1955:63, fig.; MATSUBARA 1955:713 (after Kamohara); OCHIAI, ARAGA, AND NAKAJIMA 1955:109–110, figs. 6–7, table 5 (Mimase and Owase); KAMOHARA 1964:90 (Kochi Pref.).

**DIAGNOSIS.**—A *Callionymus* of the *kaianus*-group with a small branchial opening; short head (3.6–4.4 in SL); preopercular spine with a small antrorse and two larger curved points at dorsal side, and a short main tip; high second dorsal fin with a convex distal margin; no filament in first dorsal fin; anal fin with a distal black streak on each membrane; distal two-thirds of membranes of anal fin brown, including tips of fin rays; an irregular distal margin of caudal fin; and a very small black blotch on third membrane of first dorsal fin, extremely distal in position.

**DESCRIPTION.**—Counts and proportions (see also Table 2):  $D_1$  IV;  $D_2$  viii,1; A viii,1;  $P_1$  18–20;  $P_2$  1,5; C 10.

Body elongate and depressed. Head depressed, 3.6–4.4 in SL. Eye large, 2.1–2.9 in head. Pupil about 3.1 in eye diameter. Branchial opening about 3 in pupil. Preopercular spine with a short main tip, a small antrorse and two larger curved points at its dorsal side, and a large antrorse spine at its base (formula:  $1-\overset{3}{\text{---}}-1$ ). Lateral line reaching from area behind eye to end of one of the median caudal fin rays (?); the line of the opposite side interconnected by a transverse branch across occipital region and

another across dorsal side of caudal peduncle. Caudal peduncle length about 4.8 in SL, minimal caudal peduncle depth 23.0 in SL.

First spine of first dorsal fin lower than first ray of second dorsal fin, not filamentous. Second dorsal fin very high, with a convex distal margin. Anal fin begins on vertical through second ray of second dorsal fin. Distal shape of caudal fin irregular; two median caudal fin rays elongate, occasionally filamentous. Distal margin of pelvic fin convex; longest pelvic fin ray reaching to midbase of first membrane of anal fin when laid back. Pectoral fin reaching to fourth ray of second dorsal fin when laid back.

Color in alcohol. Body olive-yellow above, whitish below. Back with both blackish spots and blotches, the former forming darkish rings. A row of several dark brown blotches along side of body. Pectoral fin base with a brown area. First dorsal fin gray, with three oblique dark bars; a black blotch distally on third membrane. Second dorsal fin gray, with several vertical dark streaks on membranes. Distal part of anal fin blackish, occasionally with a transverse streak distally on each membrane except the first. Caudal fin gray, mottled with blackish spots and small whitish blotches. Pectoral fin pale, the dorsal part mottled with dark spots. Pelvic fin gray, distal parts of fourth and fifth rays dark.

**DISTRIBUTION.**—Known only from central Honshu, Japan (Pacific coast; see Fig. 2); collection depths not known.

**DISCUSSION.**—I unfortunately had no material of this species. The present description is compiled from Kamohara (1936) and Ochiai, Araga, and Nakajima (1955).

The differences between *C. sokonumeri* and *C. altipinnis* are discussed in the description of the latter species. *Callionymus sokonumeri* differs from *C. ochiaii* in its higher second dorsal and anal fins, the shape of the caudal fin, a shorter main tip of the preopercular spine, and various color markings.

#### *Callionymus* sp.

*Callionymus kaianus*: (non Günther, 1880) WONGRATANA 1968:58 (Gulf of Thailand).

**DISCUSSION.**—I did not examine material of the *kaianus*-group from the Gulf of Thailand. Wongratana's (1968) paper records *Callionymus kaianus*, but gives no descriptions or figures.

*Callionymus kaianus* should not occur in the Gulf of Thailand. I have been unable to determine if the specimens from that area belong to any of the known species of the *kaianus*-group, or if they represent yet another species.

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